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J. P. THOMSON LL.D., HON.F.R.S.G.S., ETC., ETC., *Honorary Editor.*

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ON THE LOSS OF WATER DUE TO EVAPORATION PERCOLATION AND ABSORPTION, WITH SPECIAL REFERENCE TO THE BRISBANE WATER SUPPLY.*

(With Map).

BY GEORGE PHILLIPS, C.E., Vice Pres. R.G.S.A.Q.

Of the various elements which compose the terraqueous Globe there is none, I think, so elusive, or so subject to rapid metamorphoses as water.

The various forms in which water appears are so familiar as to excite but little surprise, so that few pause to consider that the common water of every day use is chemically identical, no matter whether it manifests itself as snow, rain, hail, ice, hoar-frost, mist, fog, dew, vapour or steam, destructive snow-slide, avalanche, cloud burst, water-spout, or flood.

Pure water—which by the way is only to be found in the laboratory of the chemist—is composed of two gases, hydrogen and oxygen, in the proportion of two parts by volume of hydrogen and one part by volume of oxygen.

Gravimetrically, water contains sixteen parts by weight of oxygen and two parts by weight of hydrogen. Pure hydrogen is the lightest of all known substances, being 14½ times lighter than air and more than 11,000 times lighter than water, hence its use in the inflation of balloons.

At all temperatures below 0° centigrade, water is a solid, whilst at all temperatures above 100° centigrade, water is a gas.

Between 0° and 100° centigrade, water is a liquid, and weighs about 62¼ pounds per cubic foot, so that, volume for volume, water is heavier than most woods, and is but little lighter than the hardest wood grown in Australian forests.

* Read before the Royal Geographical Society of Australasia, Queensland, 13th October, 1910.

B

Water is more than 800 times heavier than equal volumes of air, and yet the vapour from which rain water is condensed is conveyed with ease and distributed over vast areas by means of the atmosphere.

Assuming that aqueous vapour converted into rain is condensed at an average height of 1000 feet, the energy exerted in distributing one inch of rain over one acre in one hour is equivalent to 114 horse power.

On this basis the energy that was expended in producing the first great flood in the Brisbane River during February 1893, was equivalent to about 55,000,000 horse power exerted continuously for 120 hours, sufficient to drive all the locomotives now operating on Queensland Railways 10 hours per day for 30 years.

THE VALUE OF SNOW-CLAD MOUNTAINS.

The rivers that carry the largest volumes of water are invariably fed, either wholly or in part, by snow-clad mountains, which catch and retain the frozen rain.

Throughout the whole vast area of the Australian Continent the "Snowy Mountains" in New South Wales—of which Mount Kosciusko (7,900 feet) is the highest peak—is the only range of sufficient height to serve this purpose.

From this rather limited source the Murray and the Murrumbidgee Rivers take their rise, and to it they owe their perennial character.

It is in a great measure owing to the absence of similar mountain ranges of sufficient height to serve as equalisers of the rainfall, that the Australian continent, as a whole, is so poorly watered, and that Australian rivers, as a rule, are mere conduits for storm water.

Our own river, the Brisbane, is in this matter no exception to the general rule. On two occasions within a fortnight in 1893, the river discharged flood water at a maximum rate of about 500,000 cubic feet per second, whilst nine years later (1902) the bed of the river had to be drained for 60 miles to yield $3\frac{1}{4}$ million gallons per day, whilst the natural flow absolutely ceased for some months.

For these reasons the loss of water, that occurs in natural and artificial channels and reservoirs, is perhaps of more importance in Australia than in any other region of equal area in the world.

The loss is due to three causes, namely, evaporation into the air, percolation into the ground, and absorption by vegetation.

EVAPORATION FROM WATER SURFACES.

In the United States, evaporation from water surfaces such as ponds, lakes, and reservoirs, ranges from a minimum of 18 inches to a maximum of 100 inches, or more, per annum.

EVAPORATION IN NEW SOUTH WALES.

The following information has been kindly supplied by the Honorary Secretary and Treasurer of the Society, Dr. J. P. Thomson, and refers to the ten (10) years ended 31st December 1902:—

Annual evaporation at the following places:—

Nepean Tunnel	35.405	inches
Hay	36.273	,,
Sydney	37.128	,,
Prospect Reservoir	45.214	,,
Young	46.667	,,
Lake George	48.907	,,
Walgett	65.494	,,
Wilcannia	68.976	,,
Dubbo	71.504	,,

I have no doubt that in the interior of Australia the mean annual evaporation from water surfaces would equal if not exceed the maximum experienced in the United States.

As an illustration it may be mentioned that to maintain an artificial lake of 100 square miles in area, in the interior of Australia, would require a pipe 15 feet in diameter running constantly full at a velocity of more than four (4) feet per second to make good the loss by evaporation only. This represents nearly 400 million gallons per day, which greatly exceeds the ordinary flow of any river in Queensland.

Coming nearer home, I may mention that the mean annual loss by evaporation off the surface of Enoggera Reservoir is about 180 million gallons, equal to about one fourth of the available capacity of the reservoir when full. The loss by evaporation that may be expected in average years from the surface of the proposed reservoir at Cabbage Tree Creek, from which it is intended to augment the metropolitan water supply, would be about 700 million gallons per annum, or about one-eighth part of the capacity of the reservoir when full.

It will be seen, therefore, what a serious factor evaporation from water surfaces is in the case of artificial reservoirs during periods of protracted drought.

Evaporation from the surface of saturated soil in the tropics is about two-thirds of an inch per day.

LOSS BY PERCOLATION INTO THE GROUND.

Large as the loss by evaporation undoubtedly is, it is in many cases small by comparison with the loss of visible water by percolation into the ground.

The immense supplies of artesian water known to exist in Queensland is evidence of the great losses of surface water that occur by percolation into or through the bibulous strata that form the in-take or gathering ground for the artesian area.

When we consider how few Australian rivers can be depended upon to yield large supplies of water by natural flow all the year round, it is evident that an immense proportion of the rainfall never reaches the sea and must sink into the ground.

LAKE GALILEE, CENTRAL QUEENSLAND.

In a paper on the "Great Dividing Range" of Queensland, by Dr. J. V. Danes, quite recently presented to this Society,—it is stated that the loss of water observed by Dr. Danes in lake Galilee, in Central Queensland, at an elevation of 1025 feet, amounted to 30 inches in 40 days.

As the lake has no outlet, the water must have been lost by evaporation or percolation, probably both, and at a greater rate for percolation than evaporation.

As the lake is about 200 miles from the sea, it is evident that the rate of percolation is not controlled by proximity to or distance from Ocean levels.

THE DARLING RIVER.

In a paper read before the Royal Society of New South Wales in 1879, by the late Mr. H. C. Russell, for many years Government Astronomer and Meteorologist of that State, it is shown that assuming the run off from the whole basin of more than 200,000 square miles to be only two (2) inches per annum, the Darling River should be a perennial stream 1,000 feet wide by 20 feet deep with a constant velocity of one mile an hour.

As a matter of fact however, the Darling is a narrow and shallow stream only navigable for small vessels of light draught for about six months in the year.

Mr. Russell concludes that nearly the whole of the rainfall (from 10 inches to 40 inches per annum) sinks into the ground, or is lost by evaporation and that only a small fraction of one inch is available to maintain the ordinary flow of the river.

RESERVOIR STORAGE IN NEW SOUTH WALES.

Mr. Wade, Chief Engineer for water supply, New South Wales, in the paper read before the Engineering Section of the Royal Society in 1903, describes his experience in connection with a reservoir constructed in a fairly humid district, as follows :—

> " A concrete dam was built to form a storage reservoir in a fairly humid district. The annual rainfall was 27 inches and the catchment area was 1,500 acres. As this area was covered with slate and possessed steep slopes it was considered fairly impermeable, and no difficulty in filling the 40 million gallon reservoir was anticipated. The annual rainfall on the area of the catchment would, as a matter of fact, fill twenty such reservoirs. After the dam was finished it took over a year to fill up to top-water-level, and during this period careful observations were made of the rainfall, and the corresponding height of water in the reservoir. An analysis of these returns has been made, and it discloses some remarkable facts. During 7 months from August to April, the rainfall amounted to 17 inches, yet the reservoir gained nothing, but, on the contrary, lost 4 million gallons. In the month of January alone, nearly 5 inches of rain fell, yet the amount which ran into the reservoir was less than one million gallons. The explanation, of course, is that the rain was absorbed by the heated ground. In the following May when the weather was cooler, the rainfall was nearly 4 inches, and 7 million gallons of water were impounded ; although this is a more satisfactory result, the quantity impounded is only 5% of the fall. In the next month, June, another 4 inches of rain fell, and no less than 23 million gallons were impounded—this amounts to 17% of the fall. In the next month, July, an inch of rain sufficed to fill the reservoir to overflowing, so that the observations were abruptly ended, but on this occasion it is certain that over 25% of the fall must have run off the catchment. The conclusion to be drawn from this seems to be that summer rains will not flow off this catchment, so that half the annual rainfall must be put aside as entirely lost. Of the winter rains it may at once be said that from 5% to 25% is available if they fall at the right time. Taking the whole year round, it appears that this catchment delivers less than one twentieth part of its waters into the reservoir, a startling fact which may well enjoin caution in any future selections of storage sites."

ENOGGERA RESERVOIR.

The late Sir A. C. Gregory (who was for some years Chairman of the Brisbane Board of Waterworks) in a paper on the Brisbane Water Supply, read before the Queensland Philosophical Society, Brisbane, on 8th August 1878, stated that for the previous 22 months the delivery of water to the city from the Enoggera Reservoir had been about one million gallons per diem, and he added :—"During the twenty-two months which have elapsed since the present rate of supply to the city has been in operation there has been no overflow of the by-wash of the storage reservoir, which was quite full at the beginning of the period, but was some four feet below at the end.

Thus the expenditure of water during the twenty-two months has been 200 million gallons in excess of the natural supply, being at the rate of 300,000 gallons per diem over the capabilities of the reservoir, with a rainfall of 36 inches per annum".

The basin of the reservoir comprises 8,295 acres. It will be seen, therefore, that with an annual rainfall equivalent to a mean of more than 18,500,000 gallons per day, the net yield at the reservoir was only equal to a mean of 700,000 gallons per day, or less than the 26th part of the rainfall.

During the year 1909 the rainfall registered at Enoggera was 32.64 inches.

The estimated quantity of water drawn from the reservoir during the year was slightly under 1,000,000 gallons per day, and yet the reservoir steadily fell from 8′ 9″ to 19′ 8½″ below the by-wash. This shows conclusively that the basin of Enoggera (8,295 acres) cannot be depended upon even in fairly good seasons to yield anything like 1,000,000 gallons per diem, so that Sir A. C. Gregory's estimate of 700,000 gallons per day as the net yield of Enoggera with a rainfall of 36 inches per annum, is fully sustained by recent experience.

The experience gained at Enoggera reservoir—which lies on the Eastern fall of D'Aguilar's Range—has a very serious bearing on the proposed reservoir on Cabbage Tree Creek, on the Western side of the same Range, and therefore not so favourably situated as a source of water supply as Enoggera.

For reasons which I need not give here, I estimate the relative value of the two basins, acre for acre, as 30 per cent in favour of Enoggera. (vide accompanying map)

On this basis, and in the light of recorded experience, I consider the net value of Cabbage Tree Creek basin, in similar years to 1909,

as about 1,000,000 gallons per day, provided that the water is conveyed to the pumping station by pipes and not, as is proposed, by the natural channel of the Brisbane River.

During such years as 1877, 1878, 1881, 1885, and 1902, the basin of Cabbage Tree Creek would not contribute any water to the pumps at Mt. Crosby, via the natural channel of the river, as the whole of the water would be lost in transit.

Gold Creek Reservoir, which has a basin of 2476 acres, yielded 80,231,000 gallons during 1909, equal to about 220,000 gallons per day. The recorded rainfall was 33.41 inches. The level of the reservoir steadily fell throughout the year from 10′ 7¼″ to 14′ 1″ below the by-wash. The net yield of Gold Creek basin in similar seasons to 1909—which cannot be regarded as an exceptionally dry year—may I think be assumed as about 200,000 gallons per day, so that the aggregate net yield in similar seasons of the existing reservoirs at Enoggera and Gold Creek and the proposed reservoir at Cabbage Tree Creek may be estimated at about 2,000,000 gallons per diem—surely a poor reserve for a rapidly growing city like Brisbane.

As the proposed reservoir at Cabbage Tree Creek is designed to hold 5,800 million gallons it will be seen that had it been in existence during 1909, the volume of water contributed to storage would have been about the one-sixteenth part of the full capacity of the reservoir.

The ratios of area and capacity of the Enoggera and Cabbage Tree reservoirs are as follow :—

	Area in Acres.	Ratio of Area.	Capacity in Millions of Gallons.	Ratio of Capacity.
Enoggera ..	8,295	1	1,000*	1
Cabbage Tree ..	18,240	2.2	5,800	5.8

In view of the fact that it would probably take sixteen (16) consecutive years similar to 1909 to fill the reservoir, I am of opinion that too much reliance is being placed on the services of the proposed reservoir at Cabbage Tree Creek as an auxiliary to the Brisbane River source, more especially when so much of the stored water would inevitably be lost in transit down the natural channel of the river.

The cost of conveying the stored water from the proposed reservoir to the pumping station by means of pipes or other artificial

*This is the total capacity.—The available capacity is only about 700 million gallons.—G.P.

conduits should be included as an integral and necessary part of the scheme.

ABSORPTION BY VEGETATION.

That vegetation must absorb much moisture from the ground is obvious, but the actual consumption no doubt varies with the climate as well as with the character of soil and vegetation.

During my examination of the Gregory River in May 1909, I observed that the once luxuriant vegetation in the bed of the Barkly River—an effluent of the Gregory—is now nearly all dead owing to the accidental or temporary stoppage of the water supply by the silting up of the outlet from the parent stream.

It is stated in "Public Water Supplies" by Turneaure and Russell, published in 1905, that grain crops will consume from 10 to 15 inches of water during the growing season. Grasses require still more per day, and for an entire summer season will consume 30 or 40 inches if furnished. Baldwin Latham found that Italian rye-grass would, under suitable conditions, consume from 100 to 200 inches per year, if supplied. Forests require less water than crops, but that they consume a good deal of water is generally manifested by the increased surface flow after forests are killed by ringbarking.

Fernow gives as the ratios of the evaporation from different surfaces relative to that from a water-surface the following:—Sod 1.92; cereals 1.73; forest 1.51; mixed 1.44; water 1.00; bare soil 0.60.

The effect of vegetation upon percolation is the reverse of its effect upon evaporation.

Experiments by Wollny on bare soils 20 inches deep showed that for six months the percolation was, for sand 65 per cent., for loam 33 per cent., and for peat 44 per cent. of the rainfall. With grass growing thereon the percolation was 14.0, 1.3, and 8.7 per cent. respectively.

LOSS OF WATER IN NATURAL CHANNELS.

THE WHITE NILE.

In a paper on "Nile Reservoirs and the Cotton Crop" by Sir William Willcocks, K.C.M.G., the eminent authority on irrigation in Egypt published in "Public Works, October-December 1908" it is stated that practically half the water supplied by the Great Lakes is lost between Gondokoro and the junction of the Saubat River, a distance of 930 kilometres or 580 miles. The extent of the loss is given as 300 cubic metres per second, and is equivalent to 10 million gallons per mile per day.

Speaking of reservoirs on the White Nile above Khartoum, Sir William Willcocks says:—"The impounded waters, when set free, would have to flow down the last 840 kilometres of the White Nile before they reached Khartoum, and the losses would be heavy."

THE MURRAY RIVER.

The losses that occur in the main channel of the Murray River between Jingellic on the Upper Murray, where the area of the basin is only 2,520 square miles (about one-half of the area drained by the Brisbane River), and the junction of the Darling River where the area of the Murray Basin is about 100,000 sq.miles—have been systematically investigated by the officers of the Water Supply Department of Victoria over continuous periods of from 11 to 15 years. This investigation—particulars of which are given in the report of the Interstate Royal Commission on the Murray River, which sat in 1902—constitutes, so far as I am aware, the only systematic investigation of the kind that has been made in Australia. I give the results in tabular form at the end of this paper,—I may say, however, that each section of the river showed a loss of from nearly two million gallons to nearly four million gallons per mile per day, whilst the average loss amounted to 2,875,000 gallons per mile per day, over the entire length investigated, namely 715 miles.

THE GREGORY RIVER, NORTH QUEENSLAND.

Outside of the heavy rainfall belt on the Northern Coast of this State between Ingham and Cooktown, the Gregory is the only river in Queensland that can be regarded as absolutely perennial.

The river takes its rise in the Barkly Tableland, near Camooweal, where deep limestone deposits extend for some hundreds of miles into the Northern Territory.

Near its source the Gregory discharges about 140 million gallons daily, but in the course of 100 miles it loses about 50 million gallons.

During the month of May, 1909, I carefully examined the channel of the Gregory and its principal effluent, Beames Brook and found that the loss of water amounted on the average to half a million gallons per mile per day.

As the examination was made in the cool season whilst the water in the river channel is protected from wind and well shaded by luxuriant vegetation, I am of opinion that by far the greater part of the loss is due to percolation into the ground and absorption by vegetation.

LAKE SKANEATELES, U.S.A.

A remarkable example of the loss of water in natural channels is given in a report on the Water Supply of the Middle Division of Erie Canal, made in 1862.

Measurements made of the flow through the natural channel forming the outlet to the Lake, 10 miles in length, showed a loss of more than 3000 cubic feet per minute. This is equal to a loss of 2,700,000 gallons per mile of channel per day in the comparatively humid climate of the State of New York.

CENTRAL AUSTRALIA.

The examples I have given explain why the rivers that drain into Lake Eyre in South Australia have never found an outlet to the sea. The basin from which the rivers head in Central Australia comprises an area of about 600,000 square miles, and includes the entire drainage of the Thomson, Barcoo, Diamantina, Georgina and other considerable western rivers of this State.

It will be seen, therefore, how futile would be the attempt to realise the popular ideal of a great inland sea in Central Australia, when the entire natural flow from 600,000 square miles is unable to find an outlet to the sea and is practically lost by evaporation and percolation.

If the basin would yield an average run off of only one inch per annum from the entire area, the quantity of water would suffice to form a magnificent river 1200 feet wide by 25 feet deep constantly flowing at the rate of one mile per hour.

It will be seen, therefore, that the great central basin of Australia may be likened to an immense frying pan from whose heated surface rain is evaporated or otherwise lost almost as fast as it falls.

LOSS OF WATER IN ARTIFICIAL CHANNELS.

As might be expected very much more is known of the loss of water in artificial than in natural channels. Some valuable information on this subject is contained in " Water Supply and Irrigation Papers " of the United States Geological Survey, No. 25.

The Erie Canal (351 miles) which connects the great Lake System of North America with the Hudson River, thus providing a continuous waterway between the City of New York and the extreme Western end of Lake Superior, a distance of 1500 miles, owes its origin to De Witt Clinton, who was Governor of the State of New York early in the 19th Century. The Canal, as originally designed by Clinton, 40 feet wide at surface, 28 feet at bottom by

4 feet deep (derisively called "Clinton's big ditch") was completed in 1825. Since 1862 the dimensions of the Canal have been 70 feet at surface, with a bottom width of 56 feet by 7 feet deep. Originally the canal was designed to carry barges of 60 tons, but the enlarged section carries vessels of 240 tons.

In 1824, it was found that the loss from percolation and evaporation in the canal ranged between 100 and 125 cubic feet per mile per minute, equal to 900,000 to 1,125,000 gallons per mile per day.

In 1839, a series of exhaustive observations were made by Mr. Talcott along the Chenango Canal, which is connected with the Erie Canal. The loss of water due to percolation and evaporation over a length of 22 miles was found to be 66 cubic feet per mile per minute, equal to about 600,000 gallons per mile per day.

Mr. Talcott's report is stated to be a very able document, and presents all the data at hand at that time. His conclusions for artificial waterways of the dimensions of the early canals of the State of New York (40 feet by 28 feet by 4 feet) may be stated as follows :—

Loss by percolation, absorption, and evaporation, 100 cubic feet per mile per minute. With retentive soils this could be reduced to from 60 to 70 cubic feet per mile per minute. Mr. Talcott fixed on 66 cubic feet per mile per minute for Genesee Valley Canal, which was largely built through heavy soils, but this was subsequently found too small.

In 1841, Mr. O. W. Childs, then Chief Engineer of Erie Canal, made a series of observations on the original canal. On a section of 36 miles he found the loss from percolation, absorption, and evaporation ranged from 35.4 to 108.6 cubic feet per mile per minute, equal to from 318,600 to 977,400 gallons per mile per day.

A study of all the measurements in detail shows that in an artificial channel of the dimensions of the original Erie Canal (40 x 28 x 4) constructed on the American system, there should be provided at least 80 to 100 cubic feet per mile per minute, exclusive of water for filling and for lockages.

This means that in a length of 100 miles the losses due to percolation, absorption, and evaporation may be expected to amount on an average to 80 million gallons per day or 800,000 gallons per mile per day.

For canals of different dimensions it is considered that the loss by percolation through the bottom and sides would vary as the square root of the pressure or depth of water, and directly as the

area under pressure. From this it would appear that the loss from a canal 60 feet x 32 feet x 9 feet would be considerably more than double of that in a canal 40 feet x 28 feet x 4 feet.

PANAMA CANAL.

Since this paper was written, I have, by the courtesy of Mr. R. D. A. Frew, C.E., perused a paper on the "Water Supply for the Lock Canal at Panama," by Mr. Julio F. Sorzano, M.Am. Soc. C.E., with the subsequent discussion by five eminent American Engineers, namely, C. E. Grunsky, H. F. Hodges, Theodore Paschke, Allen Hazen, C. M. Saville, and the Author, Mr. Sorzano. The paper and the discussion cover 145 pages, as published in the Transactions of the American Society of Civil Engineers, Vol. LXVII, June, 1910.

Mr. Sorzano,—who claims to have had 40 years' experience in a branch of engineering depending to a great extent on meteorology, geology, and hydrography—estimates the rate of evaporation at Lake Gatun during the dry season at about ¼inch per day and the loss by percolation at nearly half an inch per day. The latter would, of course, operate all the year round, and would fluctuate chiefly with the "head" or depth of water in the lake.

Mr. Sorzano concludes that the water supply as planned for the lock canal will be inadequate for the most important service for which the canal is being built, namely, the use of the United States Navy, and that the inadequacy of the water supply will limit for all time the capacity of the Canal to less than twenty (20) vessels each way per day. Also that the 40 feet draught expected to be obtained in the Canal cannot be maintained.

It would be impossible to condense Mr. Sorzano's paper and the subsequent discussion within the time and space at my disposal, but I may remark that the paper is one worthy of close attention by Engineers and others interested in the greatest work ever undertaken by man.

CONCLUSION.

I have, I think, adduced sufficient evidence to show how difficult it is to determine with anything like exactitude the quantity of water that any given area may be depended upon to yield, or that can be conveyed by natural or artificial channels other than closed conduits such as pipes.

I have given special consideration to these questions because the methods decided upon for the improved supply of water to Brisbane, include storage reservoirs situated from 20 to 100

miles above the proposed pumping station, at Sugars Quarry, from which the supply is to be conveyed to the pumps via the natural channel of the Brisbane River.

I am convinced if these methods are adopted, grave trouble will be experienced in maintaining the supply in times of drought, more especially when the demand for water is largely increased, as may be reasonably expected in the future.

Perhaps I cannot do better than conclude with a quotation from "Irrigation in the United States," by T. H. Newell, Chief Hydraulic Engineer :—

Mr. Newell, writing of the loss of water in natural channels, such as rivers, says :—

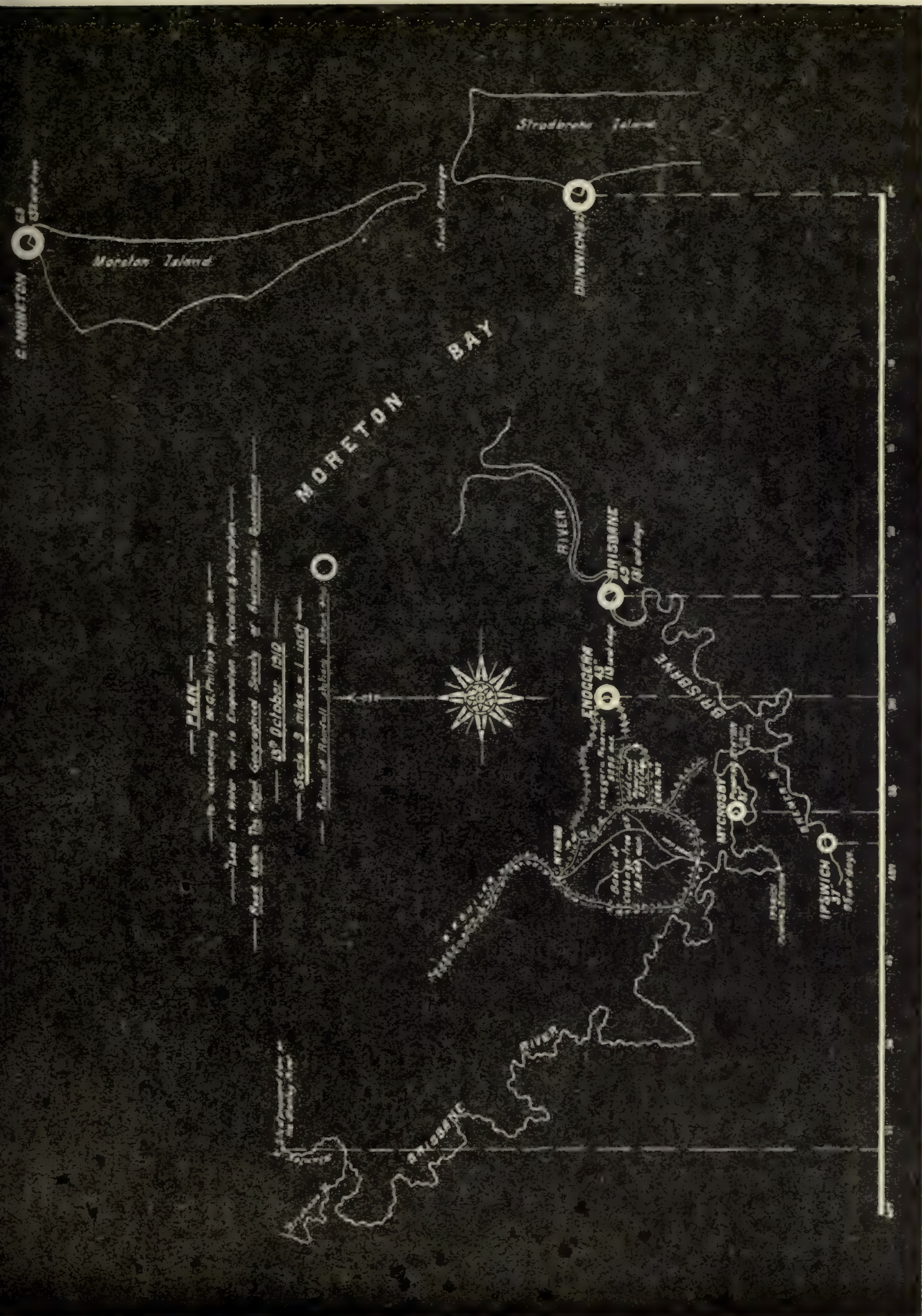
"If the stream channel were like an iron pipe or conduit, in which the water, once received, must pass along until discharged into some branch or at the lower end, the estimation of water supply would be comparatively simple. It would be assumed that whatever water came into the pipe at any point must come out at some other ; or, in other words, that the quantity to be dealt with would be constant, and our account books would balance. This, however, is not the case in nature."

INTERSTATE ROYAL COMMISSION ON THE MURRAY RIVER.

Statement of estimated loss of water in the main channel of the Murray River, compiled by G. Phillips from returns furnished to the Commission by Mr. Ettore Checchi, Chief Assistant Engineer, Water Supply Department of Victoria, vide pages 133 to 141 of the Commissioner's Report, dated 9th December, 1902.

Years.	No of Days.	Miles of main channel.	Day-Miles.	Total estimated loss in millions of cubic feet.	Average loss per day-mile in cubic feet.	Average loss per day-mile in gallons.	Section of River.
1891 to 1901	4015	60	240,900	85,194	353,649	2,210,306	Jingellic to Mitta River.
1891 to 1901	4015	15	60,225	21,724	360,714	2,254,462	Mitta River to Kiewa River.
1891 to 1901	4015	70	281,050	85.380	303,789	1,898,681	Kiewa River to Ovens River.
1887 to 1901	5475	150	821,250	252,947	308,000	1,925,000	Ovens River to Goulburn River.
1887 to 1901	5475	10	54,750	24,806	453,077	2,831,731	Goulburn River to Campaspe River.
1887 to 1901	5475	120	657,000	332,101	505,481	3,159,256	Campaspe River to Loddon River.
1887 to 1901	5475	70	383,250	145,910	380,717	2,379,481	Loddon River to Murrumbidgee River.
1887 to 1901	5475	220	1,204,500	755,602	627,316	3,920,725	Murrumbidgee River to Darling River.
Totals		715	3,702,925	1,703,664	460,086	2,875,538	Jingellic to Darling River.

The Murray River at Mildura, about 30 miles above the junction of the Murray and Darling Rivers, drains 92,000 square miles.


PLAN
MORETON BAY
Moreton Island
Stradbroke Island
C. MORETON
DUNWICH
BRISBANE
ENOGGERA
IPSWICH
BRISBANE RIVER
BRISBANE RIVER

WEATHER AND ITS CAUSES.*

BY E. C. BARTON, M.I.E.E., F.R.M.S , Etc

I promised many months ago to come before this society with a paper on these balloons which you see hanging here, and their use in weather lore, but I soon realised that the prevailing ideas on meteorological subjects were so at variance with the results of recent investigations as to impose upon me the preliminary task of giving some explanation of general weather phenomena, before describing the uses of balloons and kites for exploration of the higher regions of the air.

In undertaking this task I appreciated the difficulty of justifying, in the presence of a scientific society, the introduction of what is practically a popular lecture but may rely, for an excuse, on the words of Dr. Mill who, in bringing a similar paper before the Meteorological Society of England, said :—

" By dwelling upon the general results which have already been obtained and can, therefore, be described in popular language, we can best call attention to the value of the laborious research which is still necessary to establish great general truths and perhaps, by this means, we may also gain the assistance or support of new recruits."

In preparing the paper I have not hesitated in making use of the information available in the many writings of Lawrence Rotch of Blue Hill, U.S.A., Teisserenc de Bort of Trappes, near Paris, and of many other authors to whom I hereby acknowledge my indebtedness for data and even for diagrams and tabulated statements.

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* Read before the Royal Geographical Society of Australasia, Queensland, April 6, 1911.

Meteorology is not a subject which readily appeals to the layman. He may at times have been interested by such striking phenomena as hurricanes and thunderstorms, and may have wondered at the existence of the snow which is found on high mountains in the tropics, and of the hot winds which in New Zealand and Germany blow down into the plains from the glaciers and snow fields of the Alps. He may be interested to find, on enquiry, that a thunder-cloud forms the visible upper end of an ascending column of moist warm air, and puzzled by the occurrence of hail in connection with such a warm process.

In my own case the idea of seriously studying meteorology, never took hold until I read an account of the experiments made by an Austrian schoolmaster named Steiger, who, with tiny cannons bombarded thunderstorms to avert hailstones.

He and his Steiger " Vortex " suddenly became famous, and almost as quickly sank into oblivion, but I had been fascinated by the possibilities of artificial production of rain, and twenty years' study of the subject have not weakened my belief in the ultimate success of mankind in controlling rainfall, to a certain extent. In following up this idea, I found it necessary to study the natural process of rain production, and the investigation became so fascinating that I soon became a student of meteorology for the joy and pleasure which it affords. In the hope of arousing similar enthusiasm amongst others I come before you to-night.

The idea of weather control is not new. It has always appealed strongly to the popular imagination, and probably the Chaldeans, Egyptians and Hebrews knew something definite concerning the artificial precipitation of rain. The rain-maker has, in the East, always held a high position together with the water diviner and the medicine man, but in Europe the abundance of water was unfavourable to him, and up to the beginning of the 19th century the matter was not even considered by men of science.

In 1835, an ardent student of the weather, Dr. James Espy, of Pennsylvannia, took up the matter and proposed to overcome deficiency of rainfall by setting fire to several square miles of grass and forest country, at certain times, confidently expecting to produce thereby such an upward movement of the air as would cause a precipitation, not only locally, but over great areas, extending like a wave over hundreds of square miles. The idea was never seriously entertained by the authorities, but his theories received a striking confirmation from the experience of Captain George Mackay who, in making a survey, for the Government of Florida, through an area of swamp covered with dry "sea-grass," had occasion to fire 500 acres

of this grass during a great calm. When the fire was burning fiercely the surveyors found themselves in the centre of a refreshing breeze which was followed by a shower of rain. Mackay was aware of Espy's proposals and, therefore, felt so curious as to a connection existing between the fire and the rain that, when a few days later the party came to a larger area of sea-grass, he deliberately caused it to be set on fire while he retired to a distance for the purpose of studying the effects and verifying the previous experience.

He soon observed the smoke from the fire rising vertically in the calm air, forming a black smoke cloud, shaped like a sugar-loaf, whilst directly above, at a height of two or three thousand feet, another cloud formed, showing that the upward movement of the smoke-laden hot air had raised the superincumbent masses of air to such a height as to cause condensation. The upper cloud rapidly spread out to large dimensions and rain fell in torrents. Dr. Espy had the satisfaction of knowing about Mackay's experiments before he died.

It is interesting to note that an Australian explorer, the late Sir A. C. Gregory, applied his scientific knowledge to produce a similar result in the interior of Queensland. In this case the party were suffering from want of water, and Gregory deliberately set fire to a large area of dry grass, and succeeded in producing rain in sufficient quantity to relieve his party from thirst.

Owing to the fact that many battles were fought out in blinding rain, a belief became prevalent that cannonading caused the downpour, and, in consequence, many attempts were made in the direction of rain-making by explosions both at ground level and among the clouds. None of these experiments produced results comparable with those of Mackay or Gregory, but they appealed so strongly to the popular imagination that the advocates of this method were successful in obtaining from the United States Government a grant of £3,000 for the purpose of testing the idea on a large scale. The experiments were carried out in 1893 in Texas, and Mr. N. W. Harrington was deputed by the Smithsonian Institute to watch the proceedings. He reported that, beyond doubt, heavy explosions in the centre of an existing cloud produced an immediate momentary precipitation of rain in large drops, but that the fall was inappreciable in quantity and ceased after a few minutes. He was then commissioned to investigate the data available concerning the connections between the firing of guns on a battlefield and the falling of rain. Here again he reported that the continuous concussions might cause a few drops of rain to coalesce into drops of sufficient magnitude to fall to the ground, but the effect would be only momentary. The question as to

whether particles of smoke or dust assist in the production of rain was also investigated by him, and again his answer is in the negative. An experiment made with explosions of refrigerating liquids such as carbonic anhydride also resulted in a failure. In concluding his report Mr. Harrington refers to Espy's proposals and admits that conflagrations will, under favourable conditions, produce rain, but that the results would seldom justify the expense incurred. In spite of these failures we find that in New Zealand, in 1906, the explosion experiment was again tried but failed.

The failures do not prove rain-making to be impossible, but they show that real progress in the art of rain-making cannot be made without careful preliminary investigation, based upon accurate observations. Absolute weather control by human agency may be outside the realms of possibility, but the study of meteorology may teach us to produce isolated rains, and it will certainly put us in a position to mitigate the disastrous effects of drought and flood, by foretelling their occurrence. The collection and correlation of meteorological data has only recently become systematised, although the subject has always been of supreme interest, especially in the ages when the storage and the transport of food was unknown. In ancient times the fate of a nation frequently depended on the timely arrival of rain, and we know that sustained droughts were the immediate cause of all the great human migrations such as the invasions of the Shepherd Kings, the Goths and the Huns, while the French Revolution was precipitated by the same cause, and in 1848, rebellions took place in every country in Europe, owing to the famine arising from a succession of unfavourable seasons.

In ancient literature we find references proving the very high esteem in which weather wisdom was held by the nations of the East, who inhabited countries subject to a scanty rainfall like our own. In their case, as in ours, the prospect of a drought, or of a wet season, controlled the immediate value of property and the happiness of the people. To-day, prosperity still depends on seasons, and although improved transport facilities have removed the fear of famine, a reliable " seasonal " forecast would be of immense value.

Fortunately for us science has given us the necessary weapons, and now we only require the necessary expenditure, in observatories and staff work, to bring about the establishment of such forecasts.

In former times the " weatherman " earnestly strove to ascertain the laws underlying the succession of events called " weather" but achieved poor success because his measurements of heat, moisture

and wind velocity were too crude to allow of his making use of other men's observations.

Each one made observations of temperature, humidity, cloud movements, and other weather indications in his neighbourhood, and based his forecasts on his recollections of similar events within his own experience but, for want of instruments, such as thermometers, etc., he received no assistance in his reasoning from the experience of others, because the data lacked standard of comparison.

All rational methods of forecasting future events are based either upon a "cycle," which is a succession of a sufficient number of recorded events to include several repetitions, or upon a "theory," which consists of some plausible explanation of cause and effect. For the production of a "sunrise and sunset" table by the "cycle" process, a set of observations extending over a few years would suffice. To produce a forecast of the transit of Venus, observations extending over several centuries would be required. In former times, patient observers accumulated data during many centuries before establishing definite conclusions, but such a long process is very distasteful to the men of to-day. We try to reach our goal more quickly, and so we turn from the "cycle" method to the "theory" method, although it demands deeper study. "Theory" with its edifice of reasoning built on limited records, has enabled us to solve so many complicated problems, that we may hope, with its assistance, to fathom the mysteries of weather, and determine the causes of climatic irregularities, without awaiting the creation of a "cycle," which would probably extend over 1,000 years.

The labours of great men such as Humboldt, Buchan, Ferrel, Kelvin, Helmholtz have already cleared away many of the obscurities surrounding the subject. They have successfully investigated the properties of the air as a moisture carrier, and given us a satisfactory explanation of such phenomena as the equatorial calms, the trade winds, the dry belts of the globe, the "roaring forties," the thunder-storm, the sea breeze.

I purpose describing some of these phenomena, proceeding from the known to the unknown beginning with a reference to facts familiar to all, and ascending, step by step, the ladder of my conceptions.

Firstly, I will suppose that we are on the Western plains of Queensland, on a fine summer morning, just at sunrise. The restful stillness of the air is in striking contrast to the windiness of the previous afternoon and the "early morning calm" is so apparent as to justify its passing into the proverbial. Let us stop to investigate the cause of this stillness. We may succeed, thereby, in throwing light on

other phenomena. Let us watch the smoke of a bush fire, which is rising lazily in a great column towards the heavens. We note that, up to a height of a couple of thousand feet, it rises almost vertically, but there it is dragged along horizontally in a long thin streamer, showing that it has met a strong wind, and that the calm exists only near the earth's surface.

As the day wears on the conditions change, and ascending smoke no longer rises vertically. The windiness of the upper regions gradually spreads downwards until, towards the afternoon, it reaches the ground level, and we say that a pleasant breeze has arisen. Every morning is not calm and some afternoons are still, but the above description is fairly correct, and on the average it is literally true as exemplified in Table A.* Wherein are given the average wind velocities prevailing at different hours of the day at various heights. The same data plotted in curves show, in a striking manner, the prevalence of calm at the earth's surface at sunrise and the increase in strength of the wind towards afternoon.

TABLE A.

Time.	a.m. 1	3	5	7	9	11	p.m. 1	3	5	7	9	11
Altitude.	Average velocity of wind in miles per hour.											
3,200 ft. ..	19	18	19	20	21	21	21	21	21	19	19	20
1,600 ft. ..			20	20	19	18	17	17	19	22	23	21
650 ft. ..	16	16	15	15	15	16	16	17	16	15	21	15
190 ft. ..	9	8	8	9	10	10	11	11	11	10	9	9
6 ft. ..	5	3	2	3	5	7	9	10	9	8	6	5

In order to explain these facts, it will be well to study the movements of water, such as a swift running stream of a river in flood. A few pieces of wood thrown into the water at varying distances from the bank will show that the water moves faster in midstream than at the bank. By means of special apparatus, it has been ascertained that, at the bottom of a river, the water moves more slowly than at the surface. The lower velocity, near the bank and near the bottom of the river, is due to friction, and can be studied at leisure in a cup of tea just after stirring it round with a spoon, when it will be seen that the outer portions slow down in speed and come almost to rest, while the central portion is still revolving rapidly.†

* Table A is taken from Lawrence Rotch's Report on the work accomplished at Blue Hill Observatory, U.S.A.

† Water running past a wall, with a speed of five or six miles per hour, illustrates another characteristic of fluid movements, in the shape of swirling eddies which extend to a distance of several inches from the walls.

In a similar manner, the winds at low levels are retarded by rubbing on the earth's surface, and if it were possible to set the whole of the air above us at this moment (8 p.m.) moving at a uniform speed (say ten miles per hour) this uniformity would not last long. In a few hours the wind near the surface would have lost half its speed, and by 6 o'clock to-morrow morning the air next to the earth would have reached the condition known as "calm."

Having arrived at an explanation of the usual decrease of windiness during the night, and of the calm preceding sunrise, and found that it is altogether due to friction on the earth's surface, we will now seek an explanation of the general increase of windiness during the day, and naturally look for it in the sun at the most likely disturbing factor.

In studying the effect of the sun's rays, one is immediately struck with the fact that, although they pass through many miles of atmosphere on their way to us, they impart no warmth to it, and it is only when they strike something solid such as the rocks, trees, earth that they do any warming. In contradistinction to this interesting and important fact, we find that these objects when warmed have the power of transferring heat to the air, which the sun's rays failed to heat. Thus, in a few hours the layer of air close to the earth becomes sensibly heated, and would become painfully hot if it remained there. Fortunately, during the process of warming, the air particles expand and become lighter, so that they float up through the cooler air in little streams, which rise from every prominence. These little streams gather volume as they rise, and unite into great columns of warmed air. If, in the midst of cooler air, we could see warm air, each column would appear to us like the trunk of a giant tree with the little streams forming roots. Although the warm air is not visible, the rising columns do frequently become visible when they reach a height of 3,000 or 4,000 feet, because they then form clouds, but of that I shall have more to say later on. At present I wish to explain the breeziness of the afternoon in contra-distinction to the calmness of the early morning.

As the above-mentioned warm columns ascend, their place is filled by cooler air from above. It does not come down in streams, but the whole mass of air slowly descends, as the waters of a pond are gently lowered by the operation of pumping from the bottom, through a suction pipe. By midday it has sunk so far that we may be surrounded by air, which at sunrise was a thousand feet above us. Now, it must be remembered that the air at that height was at sunrise moving with a speed of ten or twenty miles per hour, and, although

it loses speed as it comes down, it is still moving sufficiently to give us a pleasant breeze. As the day wears on, the surface wind grows stronger, because we are then surrounded by air which at sunrise had a greater speed. After three o'clock the power of the sun decreases and all the above-described operations decrease in activity until, just before sunset, the upward streams of air have ceased. We are then receiving no further fresh supplies of air from the windy regions aloft, and the air around us is, through friction with the earth, rapidly losing the speed which it had when it first reached our level. By sunrise it has ceased to move, and we are back to our "morning calm."

We will now follow those columns of warm air which have been rising from the earth ever since morning. Were they visible as we tried to picture them, and could we see them rising at the rate of about 1,000 feet per hour through the slowly-sinking general body of air, we could notice that they behaved as the bush-fire smoke behaved. They rise up vertically through the still air, but as soon as they reach the layers in motion they are hustled along, so that by the time they reach the height at which they form clouds, we see them moving along at a speed of 15 or 20 miles per hour, which is one hundred times more rapid than their upward movements, and makes them seem to have only a horizontal movement.

The upper winds lose some of their speed in their effort to impart this movement to the rising columns, and for this reason, as the day proceeds, the winds at great heights decrease in strength.

This is true even at 1,000 feet above the surface of the earth, as is well illustrated by the records enumerated above in Table A.

The above-mentioned peculiarities of wind and temperature at great heights do not hold true in the case of mountains with the exception of isolated peaks such as Teneriffe or Egmont. In the case of ordinary mountains which are merely the highest of a series of ranges rising from the plains, the air moves in such a manner that each layer preserves its own position, gradually rising up the slopes. The warm air of the plains remains in contact with the earth's surface at the highest point, and, therefore, the temperatures observed on such a mountain are quite different to those observed in a balloon. At the top of the Eiffel Tower (1,000 feet) the daily variations in temperature, humidity and wind velocity approximate more closely to those observed in kite flights.

In considering the heating and cooling of air, it is important to note a fundamental difference between them. The "sun-heated" air expands and rises before it becomes heated to an extreme tempera-

ture, whereas the "night chilled" air becomes heavier as it cools, and, therefore, remains in contact with the earth, where it is subjected to further chilling processes.* These two important facts account for the daily heating effect extending up thousands of feet, while the night chilling affects the air to a height of only 40 or 50 feet. This also accounts for the greater extremes of temperature variation in winter when night cooling is of greatest duration, and for the greater temperature range in clear, calm weather than in dull or windy weather. On a level plain, during a calm, clear night, the layer of air close to the ground remains subject to the process of chilling until sunrise. Hence the prevalence of chilly mornings in our Western country. In hilly country the heavier chilled air flows downwards from every hillside into the valleys, and in the gullies chilly streams of air will be found flowing down to the lower levels, where the cold air slowly accumulates, filling them up, as water fills a pond and forming a "cold air lake."

Hour after hour the "lake" will increase in depth, so that the dweller in a house situated on low-lying ground will draw up his blankets much earlier than his neighbour on the hill, who will feel the chill air at a later hour, when the cold air level has risen sufficiently to invade his house.†

A study of the movements of air, during the above-described processes of heating and cooling, is of importance in relation to the growth of some crops, and especially fruit, on account of the liability to injury through frosts. The cooling of the surface of the ground by radiation at night, and the consequent flow of the cool heavy air down the slopes of hills, and its accumulation in hollows obviously results in the lowest temperatures being recorded in low-lying places.††

As long as the air is in motion little damage is to be expected from such frosts, and for this reason wind brakes must not be used in situations where they encourage the formation of stagnant pools

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* NOTE—A small article such as a blade of grass or a thin leaf containing no great store of heat will become so chilled that it will draw a deposit of moisture out of the air. It is then said "the dew is falling." In reality it is being condensed on the surface of the leaf. The same action may be seen occuring on the surface of a bottle containing iced water.

† NOTE—It is usually said that the air "suddenly turned cold" but investigation of the facts will show that the change experienced was due to the displacement of warm air by cold air. The air around us is never cooled or heated except by contact with colder or warmer substances and the process is very slow.

†† From this fact and from the presence of water at low levels has arisen the popular, but erroneous, impression that the cold experienced on alluvial flats is due to the proximity of water whereas, in reality, water's high capacity for storing heat tends to check rapid changes of temperature.

of air. Some experiments recently made at Wye, by Vinson and Russell, showed that on a 2,000 yard slope, with a fall of 580 feet, the lowest temperature was registered on the alluvial flats. At a height of 6inches above the ground the temperatures were usually 2 degrees lower than at the top of the hill, while on very still nights the difference reached 5 degrees. The warming effect of the River Wye, although only 40 feet wide, was well shown by observations taken at stations on the river bank, where the temperature was distinctly higher than a station situated 200 feet from the river. Some startling differences were found between the temperatures observed at heights of 6 inches and 6 feet respectively from the ground, which seem to indicate that, in the study of frosts, the ordinary method of temperature measurement, by instruments exposed in a "Stephenson" screen at an average height of 5 feet from the ground, does not give reliable results.

In the neighbourhood of the sea, all the processes described above are modified by the land breeze and the sea breeze, which in tropical countries form prominent features of the climate of the coast lands. To a limited extent they also exist in temperate climates. They are both the results of the fact that the temperature of the land varies more than that of the sea. While the land is rapidly heated in the day time by the action of the sun's rays, the heat received by the sea is absorbed by the water, which has an immense capacity for heat, with little rise in temperature. As a consequence the air above the sea is affected little by the sun's rays, while the air above the land is rapidly heated, and towards noon is so hot that it rises, and is replaced by the cooler air from the sea. At night the action is reversed, the land surface being rapidly cooled, while the sea remains at an equable temperature. The air above the land being now cooled becomes the heavier and flows out under the air which covers the sea, and constitutes the land breeze.

It is interesting, on a calm day, to watch, from a hilltop, the incoming of the sea breeze. As soon as the air over the land has become sufficiently heated, the cool air from the sea comes in like a wedge, under the warmer air on the land and displaces it, slowly at first, but with gradually increasing speed, until a stream of "sea breeze" 400 or 500 feet thick is pouring in from the sea like a great incoming tide. As it spreads further inland, it becomes in its turn warmed by the heated earth, and eventually rises to join in the current of air which returns towards the ocean at a height of 800 or 1,000 feet.

In connection with the sea breeze a curious phenomenon is observable at sundown when, during a period of an hour or more, the wind abates, although it subsequently comes in with renewed vigour. The explanation is as follows. Late in the afternoon when the setting of the sun is depriving the process of its energy, the enormous masses of warm air, which have been carried up from the land and accumulated over the sea, refuse to sink down, owing to the high temperature, and hence the process gradually comes to a standstill. It does not start again until the warm air, which has accumulated at a height of 1,000 or 1,500 feet above the sea, has become displaced by further supplies of cold air coming in from greater distances off the shore, and re-establishing the sea breeze which then lasts until 10 or 11 o'clock at night, i.e., until the earth's surface has become cooler than the sea.

The sea breeze sometimes extends 100 miles inland, and as an air movement it affects the atmosphere to a height of 1,000 feet or 1,200 feet. During perfectly calm weather the sea breeze and the land breeze follow exactly their own direction at right angles to the coast, but in most cases some other wind is blowing, and then a compromise takes place. Thus a southerly wind will, in this district, be modified to a south-east wind in the afternoon and a south-west wind in the morning. This affords an example of the fact that weather events are seldom the result of one cause, several causes being generally at work and producing such confusion as to interfere with the deduction of simple general laws of air movements, the chief difficulty being the separation of the various factors which obscure the processes.

Another of these disturbing factors is to be found in the regular daily variation in Barometric pressure.

These waves of high and low pressure follow the sun round the earth, the high pressure crests passing over us at 10 o'clock in the morning and 10 o'clock in the evening, while low pressure trough passes over us at 3 o'clock in the afternoon and 3 o'clock in the morning. The cause of these waves is generally supposed to be the result of the heating effect of the sun's rays, and the fact of their following the sun's movements only, and being unaffected by the movements of the moon prohibits any explanation by analogy to the tides. One effect of this daily pressure variation is to hasten the arrival of the sea breeze on our coast and to delay it on the sea-board of Western Australia.

During our investigation of winds it will be remembered that we found greater steadiness and constancy in temperature, humidity and velocity at high levels than at the earth's surface. The hourly

temperature variations occurring, on an average day, at the earth's surface frequently amounts to 7 degrees at the lower level, whereas at a height of 3,000 feet they seldom exceed 2 degrees. The explanation is that the earth's surface when heated by the sun, or cooled by radiation, rapidly affects the temperature of the air which is in contact with it, whereas temperature variations in the upper air can only be brought about by upward or downward movements.

Anyone who has used a bicycle pump is aware of the fact that air is heated by compression, but few are aware that the converse holds good. In all the earlier freezing machines use was made of the fact to produce cold. The principle may be illustrated by placing a sensitive thermometer inside an air pump receiver, where it will show a rapid drop in temperature, as the pressure is relieved by pumping, and the air remaining under the receiver expands. As our columns of warm air rise they expand in volume, and their temperature falls at the rate of 6 degrees per 1,000 feet. If we could on a very dry day follow the rising columns and could measure their temperature as they rose, we could find that starting from the earth at 80 degrees, their temperature would on reaching a height of 5,000 feet have fallen to 50 degrees, and at 8,000 feet the temperature would be blow freezing point.

In reality the rate of cooling is modified by moisture with other air masses and by the presence of moisture, which forms cloud, and thereby disturbs the whole process as will be shown later.

Table C. shows the temperatures observed in a balloon ascent made at Glossop in England during the month of August.

TABLE C

Height above sea level.	Temp. Fahr.	Humidity per cent.	Wind Direction.	Wind velocity miles per hour.
1,100 feet ..	54	80	N.W. by N.	14
2,000 ,, ..	49	95	N.W.	19
3,000 ,, ..	45	95	N.W.	23
4,000 ,, ..	42	100	N.W.	24
5,000 ,, ..	39	100	N.W.	27
6,000 ,, ..	38	100	N.W.	27
7,000 ,, ..	36	100	W.N.W.	26
8,000 ,, ..	35	95	W.N.W.	29
9,000 ,, ..	29	90	W.N.W.	32

In each of the above cases the fall of temperature would, if the air were devoid of moisture, take place in a perfectly regular manner according to the "adiabatic" rule, but owing to the presence of

moisture, the fall of temperature is checked by condensation, and the consequent release of "latent heat,"* which causes the cloud to remain much warmer than the surrounding air.

In warm weather the water contents are very large and this release of heat by condensation produces such a violent updraft as to carry the cloud to altitudes of perpetual frost. The raindrops then freeze together and in falling give us our summer hailstorms. If the storm takes place in tropical seas with their unlimited supply of hot moist air, the process may become so violent that the incoming air "feeding the storm" becomes a "cyclone," "typhoon," or "hurricane."

It will be noticed from Table C that in August (summer) the condensation point was reached at 4,000 feet, and the balloon then went through 3,000 feet of cloud, with a drop in temperature of only 6 degrees. In the case of the winter ascent the cloud line was reached at 1,000 metres (3,200 feet), and at this point a rise in temperature actually took place, probably owing to the heating of the cloud of the sun's rays, and continued until the cloud layer was passed when the temperature again fell regularly until the Stratosphere was reached at a height of 12,000 metres (39,000 feet).

The condensation line is so exactly fixed by the temperature and humidity of the air that all clouds such as cumulus, which form part of an ascending column of air, are flat bottomed. As the day proceeds and the air columns rising upward from the earth are at a higher temperature the condensation line rises. Where clouds are seen on the flanks of a mountain their height is more readily observed, and this rise of the cloud-bottom level is especially noticeable.

Having described some of the processes which are performed in the air above us, you may naturally ask for the grounds upon which such assertions are made, especially those relating to great heights. Some of the mysteries of the lower atmosphere were solved early in the nineteenth century by such men as Humboldt,

* As the expression "latent heat" is much used in Meteorology it is advisable to give some explanation of its meaning. If a kettle full of cold water is placed on the fire every addition of heat which the kettle receives will increase its temperature until it reaches boiling point, but after that the fire may rage ever so violently without causing any rise in temperature, until the water is all boiled away. The reason for this is the enormous capacity for heat afforded by water at the moment when it is turned into steam. To convert 1lb. of water into steam requires a thousand times more heat than would suffice to raise its temperature from 60 to 61 degrees. Curious to relate, the temperature of the steam produced is identical with that of the water from which it rises and therefore we say that these thousand heat units have become "latent," i.e., hidden. The "latent" heat remains in steam or vapour even though it may be floating about in the ordinary air as invisible moisture, but as soon as condensation takes place, as in our cloud at 5,000 ft. the latent heat is released.

Buchan, and Espy from observations of winds and clouds, temperatures and barometric pressures. Moderate heights of the air were investigated as soon as balloons had been sufficiently developed to enable scientific men to obtain the further data on which Ferrel, Kelvin and others built up the more recent theories, but the great development has been made during the last twenty years since instrument carrying kites and unmanned balloons have given us a regular sequence of data concerning all parts of the atmosphere up to altitudes of 60,000 and 70,000 feet.

The kites which are used for the purpose are in our days all constructed according to the principles laid down by Lawrence Hargrave, of Sydney, in his classical communication to the New South Wales Royal Society. This form is known as the "Box kite."

When kites are flown to high altitudes steel wire is used, and its weight becomes a matter for serious consideration. To support the seven and eight miles of wire used, it is necessary to fly other kites attaching them at intervals so that they help to carry the wire. As many as five or six such "tandem" kites are sometimes used. The paying out and drawing in of such a length of wire is too laborious for ordinary hand operation, and, therefore, kite observatories are usually provided with a steam engine or petrol motor to drive the winding drum on which the wire is coiled.

Some flights of long duration have been recorded where the steadiness of wind and other favourable circumstances allowed of maintaining the kite at high altitudes during a period of 24 hours or more, but these occasions have been rare. It has generally happened in mild weather, that the decrease of wind near the earth in the early hours of the morning prevents the lower kite from carrying its due proportion of the weight of the wire, and so the whole system must be gradually lowered, until the instrument bearing kite also comes down. In stormy weather the upper kites are in difficulty, owing to the enormous velocity of the wind in the upper strata, and the flight must be discontinued for fear of damage to kite and instruments.

It is very interesting to watch a meteorological kite ascent. As it rises higher and higher, reaching altitudes of many thousand feet, it may pass through several layers of cloud becoming invisible and coming again into sight on the upper side. As the wire is paid out the tandem kites are attached at intervals, so that finally the wire presents the appearance of hanging in a number of curved loops between the points carried by the tandem kites. When the flight is being brought to an end the steel wire is pulled in and wound round a drum by the power of the engine. Each tandem kite is detached

from the wire, as it comes down, until at last the main kite is brought down together with its attachment of self-recording instruments.

In addition to the recording thermometer and barometer the latter include a hygrometer to register the moisture, and an anemometer to register the wind velocity. When the kite enters a cloud the hygrometer will register a rise in the moisture to 100%. On emerging at the upper side of the cloud the aeronaut could ever hope to penetrate, because air is so rarefied that his blood would flow from nose and ears, if he were not frozen by the intense cold.

The balloons used for meteorological purposes are of two kinds—the india-rubber balloon, as made by Paturel, which is used for the purpose of obtaining records from the upper air at heights of 15 or 16 miles and paper balloons which are used only for studying air currents.

As most of you are aware, the beginnings of ballooning took place in France during that period of extraordinary scientific activity, which immediately preceded the great revolution. The brothers Montgolfier made a balloon large enough to raise a man into the air, and this soon led to flights being made to heights far exceeding that of the loftiest mountains. Although the first extravagant hopes of aerial travelling were soon abandoned, the opportunity which the balloons offered of investigating the upper regions of the air led a number of enthusiastic weather students to make ascents. In order to realise what an ascent meant to meteorology in those days we must remember that up to that time all its problems had been studied from the bottom of the ocean of air in which we live. Many valuable results were obtained from ascents made by meteorologists, but the expense of balloon voyages with instruments was so high and the danger so great as to preclude methodical investigation of the upper air by such means, and hence the results obtained were not of a general character. After many years, the development of the self-registering instruments has enabled the balloon in much reduced sizes to again play a prominent part in weather study, and to solve the mysteries of regions inaccessible even to the aeronaut.

For the study of wind movements cheaper balloons are used. They are made of varnished paper, and will rise to great heights, but carry no instruments. As in the case of the rubber balloons they are usually sent up at sunrise or at sunset, the reason in both cases being that that the sun's rays, at that time, illuminate the side of the balloon during the whole of its ascent, and make it plainly visible against the dark sky, whereas during the ordinary daylight the brightness of the sky forms an unsuitable background for following

the balloon more than a few thousand feet on its upward course. They must not be inflated to more than one-fourth of their capacity, or else they would burst at a moderate height.

Fig. I. shows the heights to which manned and unmanned balloons have reached. For the purposes of comparison a number of mountain peaks are indicated on the diagram.

E stands for Mt. Etna (volcanic).
T ,, ,, Peak of Teneriffe.
R ,, ,, Mt. Monte Rosa.
B ,, ,, Mt. Blanc.
C ,, ,, Mt. Chimborazo (volcanic).
K ,, ,, Mt. Kinchinjunga.
E ,, ,, Mt. Everest.

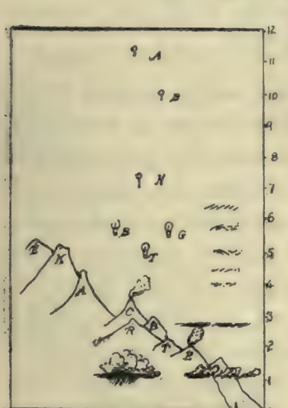

Fig. I.
Balloon v. Mountain Altitude.

The larger balloons shown are those which carried observers as well as instruments. They are marked with letters representing the names of the respective aeronauts. G stands for Glaisher, T for Tissandier, B for Berson. The smaller balloons depicted are "unmanned" instrument carriers, which reached heights exceeding 7 miles. They are marked H, for Hergesell, T. for Tiesserenc de Bort, and A for Assmann, these being the names of the men who launched them. The heights are shown in miles.

The figure also shows the heights at which the various types of clouds are observed. The cumulus is shown at its average height of one mile. Stratus clouds are shown at 3 miles, and the various forms of cirrus clouds at heights of 4 to 6 miles. At the lower right hand corner the Eiffel Tower is shown.

I must now describe briefly the instruments which the balloons and kites carry, such as recording thermometers, barometers, etc. Casting our thoughts back a couple of centuries to the time when heat and cold were only relative terms and when air pressure had not yet been studied, we find the earliest reference to the use of the thermometers in a work written by Galileo three hundred years ago,

but Fahrenheit was the first to make uniform instruments of sufficient accuracy to allow of making reliable observations in various parts of the world and comparing them.

About the same time came the great invention, by Torricelli, of the barometer, which threw a completely new light on the movements of the atmosphere.

The ordinary barometers and thermometers are, however, suited only for observation work. For kite and balloon work other forms are used, which are capable of producing continuous records of heat and pressure variations.

A very elegant type of recording barometer is the barograph recently installed at the Weather Bureau in Brisbane. It will be noticed that the usual spring control has been done away with and replaced by a large brass weight which hangs from the vacuum cylinders, and gives a movement of great power.

The kite instrument is much lighter, and of the general type. The record is made on smoked paper attached to a revolving clock drum, the trace being scratched by a metallic point, which in the case of the thermometer record obtains its movement from the curling and uncurling of a strip of composite metal, made of thin sheet iron and thin sheet brass, riveted together. In recording the barometer readings the movement of the point is obtained from the movements of the cover of an airtight metallic vessel, which contains no air, and is, therefore, sensitive to the variations in air pressure. The mechanism is almost identical with that of the well-known " Aneroid " barometer. For the measurement of variations in dryness of the air another instrument has been devised. It is known as the hygrometer and its construction is based on the fact, that a piece of horsehair becomes shorter in damp weather and longer in dry weather. The toy which alternately shows a little lady with a fan, and a little gentleman with an umbrella coming out according to the weather, exemplifies the same principle. In the case of the kite hygrometer the movements of the horsehair are transmitted by a little aluminium lever to the recording point. All three records are made on one clock drum.

The reords obtained from balloons are not so complete as those resulting from kite flights, as they do not include the velocity of the wind, which in the kite instrument is obtained from a modified Robinson's anemometer, but they ascend much higher.

Balloon ascents are usually made at sunrise or at sunset. After the balloon has been filled to a suitable extent with gas the instruments are attached and the whole apparatus is released at a signal given by the observer in charge of the flight, while an observer watches the balloon with a ' Quervain " Theodolite, which is a modification of the ordinary surveyor's instrument. The observer follows the movement of the kite, keeping it in full view during the hour or more which the ascent occupies. As the balloon rises the decreasing pressure of the surrounding air causes the balloon to swell until, when it equals five times the original volume, it bursts. The fragments of the balloon form a parachute during the descent of the apparatus to the ground, and little damage accrues to the instruments, which are made almost entirely of aluminium, and, therefore, are very light. The apparatus can generally be used many times, provided that they are recovered.

The results obtained, so far, from " unmanned balloon " ascents and kite flights have led to the establishment of the following main characteristics of the ocean of air at the bottom of which we live.

Firstly, there is a layer in contact with the earth, and extending up to a height of about 10,000 feet, wherein are performed all the functions which are of importance to mankind, such as the production of cloud, rain, hail and snow, the occurrence of storms and calms, lightning and thunder. We will call this the " Cumulus layer."

Secondly, there is a layer of air extending from a height of 10,000 feet up to 60,000 feet, which may conveniently be called the " Cirrus layer," the movements of which control the most of the phenomena occurring in the Cumulus layer.

The third layer, which is known as the Stratosphere, comprises all the remainder of our atmosphere up to its full height of 40 or 50 miles. It has only recently been investigated and, so far, it has been found inert, almost devoid of movement or change, and slightly warmer than the upper part of the " Cirrus layer." Apart from its absorption of a small quantity of the sun's rays and from its value as a day-light diffuser, it appears in the present state of our knowledge to be of little importance to mankind, but our information has only recently been obtained, and is based on records obtained from balloon flights made almost exclusively in Europe. In order to account for the relative unimportance of the " stratosphere," it should be further explained that, at such great heights, the air is so extremely attenuated that, in spite of its thickness of the actual 30 or 40 miles it is not equal, in air contents, to one-fifth of the " Cumulus " layer.

As mentioned above, all the important weather phenomena take place in the first few thousand feet of air above us, i.e., in the "cumulus" layer, but under the influence of the "Cirrus" layer, in which all the great movements take place, by which air is carried from the equator towards the poles. Wherever air is found descending from the "Cirrus" layer intense dryness prevails, whereas at all points where it ascends from the "Cumulus" layer, heavy clouds are produced with copious precipitation of rain. The air which rises in the tropics from the surface of the ocean into the cirrus regions deposits all its moisture in the form of rain during the ascent, and the bulk of the resulting dry air comes down to the earth's surface in the dry belts which lie immediately to the north and to the south of the equatorial rain belt.

In moving away from the equatorial regions towards the north and towards the south these masses of air which at the equator were moving eastward with a speed of 15 miles per minute reach their descending point with little loss of velocity, and if at Thargomindah we could see the cirrus layer, it would appear to be moving with great speed, because Thargomindah is moving towards the east with a speed of only 12 miles per minute, while the cirrus cloud above would have most of the original speed (15 miles per minute) acquired by the air when at the earth's surface near the equator. Thus the cirrus cloud would be travelling over Thargomindah with a relative speed of 3 miles per minute, i.e., 180 miles per hour. As a matter of fact, the relative easterly movement of the cirrus layer generally averages 15 miles an hour, or 400 miles per day. When we reach the latitude of New Zealand and further south, where the relative velocity of the cirrus layer is greater, we find this influence so powerful that the cumulus layer is dragged along in an easterly direction with such steadiness as to constitute an almost unvarying westerly wind, and the velocity is so great at the surface as to have given these latitudes the name of "roaring forties." In the northern hemisphere the same effect is traceable only to a limited extent, as the influences of great mountain ranges such as the Rocky Mountains, Alps and Himalayas produce irregularities which efface the regular course of such winds, but the reputation of the Bay of Biscay is intimately connected with its position in the "forties."

As above mentioned, the lower or "Cumulus" layer is the seat of all the more important weather occurrences. It contains more than half of the atmosphere, on account of its greater density, but all its movements, cyclonic and anticyclonic, thunder-storms and calms are subject to continuous rubbing or brushing action from the

"Cirrus" layer, and we may consider the cumulus layer as being dragged and rolled around the earth in an easterly direction at the rate of about 400 miles per day, in much the same manner as the sand carrying layer of air on the sea-shore, is swirled and hustled along by the wind above it. Like the sand layer it may deposit its burden, and may form circular and other swirls, as evidenced by the cyclonic depressions, but as a whole it is continually subject to the action of the steady wind above it.

With such apparatus as has been described we now have the necessary weapons for attacking the problems of air circulation in the upper regions which hitherto, on account of their inaccessibility, baffled our efforts. When once we have mastered these problems we shall be able to determine the causes of climatic irregularities, and then the great goal of meteorologists, the forecasting of seasons, will have been attained. It is unnecessary in Queensland to dilate on the benefits to be obtained from a foreknowledge of drought or flood, but it must be clearly understood that to accomplish this great work, much additional information is required concerning the conditions prevailing in the atmosphere above us, and to obtain this knowledge and put it into convenient form for study calls for the expenditure of labour and money. For this purpose more stations and more apparatus are required, while it is imperative, not only that our Meteorological Department should be provided with an adequate staff for the collection of data but that highly qualified men, such as the Commonwealth Meteorologist, should have leisure to co-ordinate the mass of collected facts and apply themselves to the solution of the great problems which await them. In Western Europe, and in the United States, we find that much is being done in this direction. The Governments of the United Kingdom, Germany, France, Austria and Russia have equipped fine meteorological observatories and provided staffs sufficiently large to allow of the scientific men in charge applying themselves to higher scientific work, while subordinates carry out the routine work of making observations, tabulating them and publishing daily forecasts. In the United States and India some excellent work has also been done in the same direction.

In the Southern Hemisphere, unfortunately, little has been done, and this is the more regrettable because of the more promising nature of the field, owing to the presence of large areas of ocean, where the natural circulation of the air proceeds without disturbance, and may, therefore, be studied to better advantage than in the Northern Hemisphere, where the presence of larger continental areas and of high mountains gives rise to more complicated air movements.

Meteorological work has, in Australia during the last 15 or 20 years, been hindered by want of adequate funds and by the clamour for daily forecasts. At the present time the Department is undermanned, and the energies of the whole staff are concentrated on the harassing work of producing daily forecasts, while the more important work of tabulating and co-ordinating each year's work is out of the question. As regards scientific work of a higher order, we are living, in a meteorological sense, on the work done by the State Meteorological Departments during the eighties, and more particularly on the work of Mr. Hunt when he was assistant in the New South Wales Department under Mr. Russell.

Even in the collection of data we are sadly behind the times, as we have no properly equipped observatory away from the coast, and the existing observatories cannot boast of a kite or balloon station amongst them.

The remarks made by Dr. Lockyer in a recent book on "Australian Meteorology" on this subject may be appropriately quoted here. He says, "Attention may be drawn to the fact that the great hindrance met with in making investigations of the Australian climates has been the difficulty of obtaining the necessary data. If the data did not exist, one would bow to the inevitable; but they do exist in considerable quantity, although to a large extent they remain unpublished. Thus, in the case of Queensland, a most important area for the study of Australian weather changes, meteorological observations have been made for a considerable number of years, but the only observations that could be utilised in this enquiry extend from 1896 to 1905, a period of 10 years. Even these have not been published, but were sent in manuscript form on application."

To foster the study of Australian weather among workers both in and out of this continent, it is most desirable that the observations, on the collection of which so much time and money have been spent, should be published as soon as possible, because their utility depends on their quick dissemination and accessibility. We must also increase the number of meteorological stations, for the purpose of collecting more data.

Unfortunately, our present meteorological work is focussed upon the production of a daily forecast, and, therefore, all observations are transmitted by telegraph to the Central bureau, at a heavy cost for telegrams. For purposes of scientific investigation it is not essential that the data should be sent in daily, and generally it is sufficient for the purpose that the observations be made by means of self-recording instruments without human intervention except for the

purpose of winding up clocks and replacing record sheets once or twice in a month. Such stations are now being established on the continent of Europe at an outlay of £250 each. Their annual maintenance does not exceed £25. The records obtained from these stations are of no value for daily forecasts, but form a necessary part of the data required for the solution of the great problems of meteorology.

FROM THE MEIN TELEGRAPH STATION, N.E., TO LLOYD'S BAY, AND UP THE LOCKHART RIVER TO ITS HEAD. *

BY J. DICK.

Very few people have any idea of the extent of the Cape York Peninsula, except those who have travelled over a portion of it, or of the many difficulties and obstructions there are to contend with in new country while out on a prospecting expedition with a team of loaded pack-horses, cutting ones way through scrub, and making crossings over boggy creeks, etc., etc. I thought I had a fair idea until we undertook this trip, when I soon found out my mistake.

Our party consisted of three, John Dick (leader), James Dick, and Arthur H. Sheffield, with twelve horses (9 pack and 3 riding horses.

The Government gave us a small grant for rations, etc., and train passes to the Laura, 70 miles, we finding our own horses, packs and other gear.

From the Laura we travelled overland to Fairview and Musgrave Telegraph Stations, thence to the mining centres of Yarraden, Lukin, Ebagoolah and Coen; then on to the Mein Telegraph Station, about 350 miles from Cooktown, thence to Lloyd's Bay and up the Lockhart River.

There are a large number of people, I believe, who think that prospecting is an easy and happy life; in some cases it may be, but my advice to those who think so is just to try it for six months, it may be good for themselves and profitable to the Government.

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* Read before the Royal Geographical Society of Australasia, Queensland, May, 31, 1911.

I want to say a few words about prospectors before entering into a description of our route, by way of a preface, so that my hearers may better understand their position.

The prospector stands on a very different footing in many ways to the explorer. Although both are explorers, the latter is generally well equipped, at Government expense, with all necessary requirements to aid science, etc. The prospector generally goes out in his own time, with his own equipment—often with a bad outfit and no pay.

The explorer is generally a scholar, a scientist, a sketcher, a man who understands the sextant, measuring time and distances, latitudes and longitudes, steers by compass, maps out the country, takes bearings and measurements from given points. By so doing he is able to get correct data of the country travelled over, filling in details of interest to science, geology and botany, and mapping out the mountains, rivers and plains for future use. Hence, he becomes a most useful member of society, and often is rewarded for his labours, which he justly deserves.

On the other hand, the prospector is a bushman, a miner, and a bit of a geologist, with a shrewd idea or scent for gold. He shys clear of flats and plains as soon as he can, and makes for the rough mountains and the heads of rocky or stony creeks. He dives into the thick scrubs, and with the aid of the sun cuts his way to where he wants to go. He looks at the sun and stars and steers his course accordingly. He has a shrewd idea of the lay of the country he is making for and of the class of rocks he is likely to find reefs in, and of gravelly wash in the river beds likely to contain gold. He takes in at a glance the conditions of a creek, and the probable amount of work there will be to get to the bottom or bedrock, for he has to consider the rocks, the quantity of sand and water, and the depth he will have to go before starting to sink. If all these conditions are favourable he proceeds to sink and prospect. If he comes to a creek where these conditions are not favourable he runs it up and down in search of some indication from a miner's point of view before he tries.

The prospector usually has not the time or inclination to delineate what he sees, nor instruments to correct data, which are out of his province.

If successful in finding payable gold he reports his discovery, often without reward. In describing the locality he generally gives valuable information about new country passed over, rich lands, mineral mountains, rivers and creeks containing gold or tin and valleys hitherto unknown. His reward is *Nil*, not even a distinguishing

badge of merit; no honour of any kind has ever been bestowed on the prospectors who have done so much for all the States, and in Queensland in particular he has been neglected.

The prospector is a developer of the first order. He makes known the mineral wealth; he explains the details of the country, mountains, rivers, creeks, etc., not spied from afar, but actually gone over. He is an eye-witness to the great resources he has discovered; his evidence is largely sought after; and the country is opened up as a result of his labours.

To make my meaning clearer, I will, with your permission, use one or two illustrations.

The Governments who have been entrusted with vast territories by the Imperial Government, so that they may develop and utilise them as speedily as possible have been rather slow and unprogressive.

Away back in 1848, some sixty-two years ago, the Government then in power sent out Kennedy, an explorer, from Cardwell, the then furthest outpost of civilisation, to the unknown North, to open the way of the Peninsula. Kennedy crossed and named many rivers, but his unfortunate end deprived the country of much valuable information.

Later on in 1871, our own Government despatched Mr. Wm. Hahn from Brisbane, via Mount Surprise, to explore the country N.W. He discovered and named the Palmer River, and gave the information that it was a likely auriferous country. But it remained for some time obscure and idle, till Mr. J. V. Mulligan and party proved and proclaimed to the world its richness and brought thousands of pioneer miners and others to develop its mineral and pastoral resources.

The fact of something like 60 tons of gold being unearthed from the Palmer (over £6,000,000) proves most effectively the developing power of the prospector and miner. But the prospectors did not stop here, for they opened up the Hodgkinson, Herberton, the Walsh and Tinaroo, and Chillagoe mineral fields, and other fields further north and west.

In 1879 the Government sent out Dr. R. L. Jack, to examine the Peninsula, and to gain such an idea of its structure as might serve to throw light on its value as a possible metalliferous country. He did much good work and gave valuable information.

In his report he said of his two journeys north: "If they have not added to the mineral wealth of the Colony they have, at least, increased our knowledge of its physical geography, and dispelled

much mystery which has hitherto enveloped the geology of the Cape York Peninsula."

He followed up part of Kennedy's route and went further afield; but it took the prospector to open up the Coen, Starke, Ebagoolah, Rocky, Munburra, Alice, and the surrounding smaller fields, and to prove their mineral and pastoral wealth, and settle the people.

As a first developer the prospector has no equal; settlement soon follows close on his heels, and the colonies have grown in wealth as the mineral riches have been unearthed.

It has been computed that £500,000,000 worth of gold has been circulated amongst the States, to say nothing about other mineral wealth, such as silver, copper, tin, wolfram and other metals and precious stones.

I trust my hearers will pardon me for having digressed a little in my preamble, in order to try and place the prospectors in a better light, and in a more worthy position, and to show that they have not been honoured or recompensed for the amount of good they have done.

As a benefactor, the prospector has made two blades of grass to grow where only one grew before. The following lines (slightly altered) express his worth.

"For the toiling prospectors
Are the masters of the years.
Are makers of our destinies and builders of our Land;
Yea, our standards are
Men with drill and hammer-bar,
Who hear Australia calling them, and serve with faithful hand."

THE OUTPOSTS.

The Mein Telegraph Station is an outpost in the true sense. We arrived there on the 27th June, and were hospitably received by the master in charge, Mr. Wade Robinson, who did all he could for us. He is one of those sentinels who guard the outpost of civilisation, welcoming all who come to help on the advancement of the Peninsula, and cheering them on their way.

The following verse most suitably describes the outposts' position.

"Beyond the noisy railway, outside the postal roads,
Where swing no swaying coaches, no coaster wharfs her load,
Where broad dark-gullied ranges, where brown plains meet the sky,
In scrub and bush and jungle the lone bush outposts lie."

We left the Mein on the 1st July going N.E., passing over fair pastoral lands with running streams, crossed the low table land and

conglomerate ridges called the Geikie range, came on to an old camp that had been formed in the early days to protect the constructors and those in charge of the telegraph line in 1887, 23 years ago. This was partly well-watered and grassed right on to the Batavia, a fine big river, with many tributaries draining the McIllwraith range and running N.W., with high banks and lily water-holes on the flats. The river showed very high flood marks ; it must have been a mighty river during last years' floods, yet well confined.

It enters Port Musgrave on the Western coast at Mapoon Mission Station, many miles below (about 130 miles) where we crossed it. We then followed it for a while in the direction of the Bowden Mineral Wolfram field towards the Pascoe ; then turned and followed up the Sefton, a large branch of the Batavia named by Dr. R. L. Jack—31 years ago, January 20th, 1879—after Bab Sefton, the prospector of the Coen. Then our difficulties began. Long, heavily matted grass of many years standing barred our progress ; although difficult to burn at this time of the year, we succeeded in leaving a good running fire behind us, though that did not help us.

This country for miles would make a good cattle and horse station, being naturally fenced in with high ranges, part of the McIllwraith on our left to the N.W., and Sefton Creek on our right to the S.E., forming a fair size station all ready fenced by land and water, miles of firm country to ride over without dangerous ruts or melon holes, above flood mark, with lily lagoons here and there. We crossed and recrossed this splendid tract of country and the creek several times cutting our way through scrub to find a crossing, prospecting as we went along till we came to a divide, pushing our way through heavy green grass from one tributary to another, cutting and forcing our way slowly up and across country, burning heavy grass flats and recrossing creeks to avoid the roaring, crackling flames of many a grass pocket.

Many townpeople have no idea what it is to see big plains on fire, with half a dozen years' growth of grass matted together. It illuminates the horizon at night and beclouds the sky by day.

We had a variety of changes to keep us lively ; sometimes a horse turns turtle into a hole and has to be dug out ; then another capsizes into a creek with our beef on ; another rolls back down an embankment with case goods on, and has to be helped up or unloaded, and such like.

On crossing the divide from the Western to Eastern waters the grasses change in many places to the blady variety, but there is a variety of mixed grasses besides.

Our main object in burning all the country round was to enable us to see reefs and to get into gullies to prospect, and to have good and easy travelling back. In this particular locality it was an ideal looking place for gold, nice worn down hills, plenty of reefs, the right class of rocks, but no gold; open forest country and ranges E. and W. of us. A miner would say there ought to be gold in such a place, but such was not the case, so we were compelled to leave.

One of the dreaded terrors of a prospecting party far away from medical aid is sickness in the camp. However, we were blessed with good health, but one of our mates strained himself in trying to lift up a fallen horse, which necessitated us camping two days, giving us time for reflection.

I could not help thinking when viewing the vast stretch of country around that the Government was a bit slow in helping to develope it, considering that Dr. R. L. Jack and his party were over part of this country and named the creek, Sefton, in 1879. What a satire on progress! Through all these long years no progress, no advancement, no encouragement given to open up the country mapped out by a Government explorer and geologist, still left in the same idle state as it was 31 long years ago, unimproved and in a healthy position.

One would naturally ask whose duty it is to open up this public estate, and why encouragement has not been given to open up this unimproved estate. Is it because it is too far North? No place should be too far away within a country domain.

Although in the vicinity of Dr. Jack's route North we never had the luck to come across any of his marked trees. We only came to one tree marked WL which we believe to have been marked by Mr. W. Lakeland, the prospector of the Rocky Goldfield. Here we made for the mountain range, expecting to find a water course near by, but were disappointed; we found nothing but impenetrable underbrush scrub, so had to retrace our steps over poor, miserable country, thickly timbered, heavy travelling, poor grass and no gold.

We had great difficulty in finding a crossing and had to cut long tracks through scrub on the head of the Sefton to get eastward.

It is said every black cloud has a silver lining. After several hard days for man and beast we were delighted to come on to a fine tract of land, suitable for a sheep station, on a high tableland. Here again we had to burn, the fires raging like contending forces on a battlefield. All night the red lines were meeting in deadly conflict, flames mounting up 20 feet high, crackling and roaring like artillery, retreating and advancing like foes on the march; the sight was splendid, grand, and the noise awe-inspiring.

Next morning all was silent. We rode over the scene of the previous night's conflict; nothing but charred trees and burnt ash carpeted the ground, dismal to behold but pleasing to us to travel over, knowing full well that in less than a month a beautiful crop of green velvet grass would gladden the heart of the wandering prospector.

The country was undulating plains and valleys, with little rising bald hills, with an elevation, I should think, of 1,000 feet. I saw no spear grass. All the big trees standing had the appearance of having been ring-barked by previous big fires; they were all dead. There were permanent running creeks, and a healthy breeze blowing from the coast. A mountain (Mt. Carter) stands out as a prominent landmark for future guidance; from the top of this mount I gathered some orchids. I consider it 1,500 to 2,000 feet high.

On leaving this beauty spot we proceeded toward the McIllwraith range, and had the good luck to find burnt feed and some new horse tracks. To our surprise we struck a sandal-wood track over the range, winding round ridge after ridge, then entering a long dense scrub a bit steep in places.

It only took us three-quarters of an hour to descend the range, whereas, if we had not found this cutting, it would have taken us perhaps a week to cut through, with risks to our horses.

At the foot of the range we camped on a beautiful cattle homestead of thousands of acres. We prospected the creeks without success.

Next day we resolved to see where the sandal-wood getters delivered their valuable loading. We had a splendid view of the high range we crossed. We also saw other ranges ahead and valleys between, which proved to be the coast ranges near Lloyd's Bay, called Heming range and High Peaks range, and we also saw the outline of a big river, which we were determined to see; thanks to the sandal-wood men our course was comparatively easy.

We crossed a big creek which we believed to be the Greyhound, named by Dr. Jack after a horse that fell down in one of the mountains branches. After passing over about a dozen more water-courses we reached the river near tidal water, or rather fresh water backed up with the tide. The camp was deserted, only a few old cases which told us it was one of Mr. H. Giblett's sandal-wood landings.

The river was about 30 yards wide and 6 to 8 feet deep, the tide going out; with firm, high, dry banks fit for a small seaport town. The river proved to be the Lockhart, named by Dr. R. L. Jack after a friend of his in Edinburgh, as he viewed it from Macrossan range 30 to 40 miles away. I roughly estimate we were within 10 miles of the mouth of the Lockhart, which discharges into Lloyd's Bay.

The distance from the foot of McIllwraith homestead to here would not be more than 15 miles over flat country.

From this landing to the good land I have described as a sheep station over the range on the tableland where the big fires raged, is only about 25 miles. To the good pastoral country on the Sefton and Batavia it can be reached in 40 miles by an easy route. The whole route to the Mein could be accomplished in about 80 miles, although we made it much longer, winding about, crossing and recrossing creeks so often, and dodging scrubs.

Although we did not find gold-bearing country down in this direction, we were pleased with the fund of information gathered, having located a short route to a *port* on the East coast, from the Mein, over a fair tract of good land fit for settlement.

I consider the information gained invaluable to future settlers, as a means of opening up a large portion of the Peninsula. A good track or road can be made by native labour over some boggy flats and creeks to the foot of the range, at little expense for traffic.

LOCKHART.—MEIN TO LLOYD'S BAY.

Having given a brief review of our journey from the Mein to Lloyd's Bay, I will now proceed to describe the country up the Lockhart, and give some incidents in connection with the early attempt to discover a river into the country.

Over 38 years ago, a naval officer of merit, Captain John Moresby, while cruising along the East coast, Torres Straits, New Guinea, and Polynesian Islands, called at Lloyd's Bay, January, 1872.

He said :—" Wishing to clear up a doubt as to the existence or non-existence of a river reported at the bottom of Lloyd's Bay, we stood in and anchored near Low Island and Lloyd's Island."

Captain Moresby was a shrewd judge of coastlines, and of the requirements for a port and of the great necessity there was for a port here, for this part of the Peninsula, judging from the contour of the coast, for he says :—

" It will be seen by a glance at the map of North Queensland that a river would *be a rich gift of nature here*, as affording an opening into the country, and a highway for the transit of pastoral and agricultural and mineral produce."

Had he been gifted with the gift of prophecy he could not have uttered a more important, truthful, and stronger sentence than he did; but he was doomed to disappointment. Captain Moresby started, assisted by Navigating Lieutenant Connar and Mr. Mourilyan. He says,—" At daybreak we began our search for the river, and

explored one salt water creek after another, but each was a failure, and led only into entanglement in swamps where clouds of mosquitoes resented our invasion of their hold. There was *no river*. The drainage of hills and ranges (Heming's) six or seven miles inland had created swamps of many miles in extent covered by mangroves, and intersected by these salt water creeks, and that was *all*."

It must have been a bitter disappointment to a man of ability like Captain Moresby, to acknowledge defeat when he felt convinced that nature proclaimed there ought to be a river for the benefit of future generations. But such was fate. It was left for Dr. R. L. Jack to announce to the world the discovery of a river seven years later, which he only outlined in the distance with glasses. Our party had the honour of first traversing its fertile plains, 31 years after its discovery, and travelling from the sandal-wood landing to the head on the W. side, and down it on the E. side, under the coast range, High Peak, Chester, Meston and Adam's ranges, prospecting up and down the head waters of the Lockhart, crossing innumerable gullies, ravines, and creeks, and getting colours in most of them. The distance traversed up and down is over 60 miles. Dr. R. L. Jack reported that the Lockhart is skirted by a large untimbered plain, which we can verify, as we have been over it.

Hearing there was some likely gold-bearing country down the river, we took three days' supplies and three horses from our central camp in the Valley of Hills, and started under the W. side of the coast range. We found very poor indications of gold, but instead found great plains miles in extent, where we had to force our way through long, heavy, tangled, matted grass of many years' growth. No one can imagine the source of annoyance and difficulty such masses of grass are to the prospector, probably very few ever saw such thick tropical growth or have ever travelled over new country. The horses fetlocks were skinned and bleeding from constant chaffing, so that rags had to be tied round for their protection.

We could not start to burn till we got the wind in our face, knowing full well that if the wind was behind us we would soon be enveloped in flames. When we got the fire started it raced with leaps and bounds, many feet high, travelling with the wind at a great speed, many miles an hour. As we travelled along I dropped matches on our route, increasing the rapidity of the flames, and the volume of smoke, until we were compelled to seek refuge by crossing the river to camp. We had some difficulty in finding a crossing with raging flames behind us. Luckily, on the other side there was newly burnt feed, the result

of our previous fires on our outward trip. I am sure we must have burned 20 miles square of country as the fires raged for days.

This rich, agricultural, sugar or rubber land is beautifully drained, is as level as a bowling green, and is miles in extent, ready for the plough, being over 6 miles wide by 15 to 20 miles long, as far as we could see. I am sure no white man had ever crossed those plains before. We did not follow the plain down but turned in sight of Heming range. There is a good deal of poor and timbered land under the coast range that will be useful some day for firewood for sugar mills. On the other side of the river where we camped to escape the fire, there is a plain a mile wide and very long, and other patches of good land right up to the McIllwraith range, probably 8 miles; between the two ranges it is about 15 to 20 miles.

The Lockhart has high banks, at least 25 feet high, of alluvial loamy soil, and sedimentary rock in the river with about 3 feet of water, and with but few snags in it. It seldom overflows. I only noticed one place below our camp slightly.

A creek coming from the McIllwraith range and junctioning with the Lockhart, near where we camped, I named Sedimentary Creek, as the bed was composed of that rock; it was a deep narrow creek hard to cross.

Another creek on the other side I named Rocket Creek, as our pack-horse of that name capsized and damaged our flour.

This treeless plain of rich land is ready for the plough, and it cannot be more than 10 miles from the landing, or 20 miles from the mouth of the river at Lloyd's Bay.

I see by the map that the Government has reserved 2,560 acres for a town reserve. (G.G. 1889). I have not seen it, but would imagine a suitable site can be obtained near the mouth of the river. The Government has also reserved for the use of aboriginals 985 square miles, (G.G. 1908). Evidently, the Government has taken time by the forelock to have plenty of room, without doing anything to open up the port or the land for settlement, which, to say the least, does not say much for Queensland enterprise, energy or ability to open up the land entrusted to them. I may have something more to say on this subject later on in other articles. I predict a great future for these alluvial valleys and flats, the Promised Land, which Dr. Jack was allowed to view at a distance, 31 years ago.

From an agricultural point of view, I consider it is important that the public should know that there is so much good country lying idle. I consider special concessions in land and rents should be given to young pioneers and rubber men, who are willing to open up

this vast tract of the Peninsula, and the most northerly port. It means the opening of the Peninsula into the interior as far as the Mein Telegraph Station, and as far South as Hay's Creek and Nesbit, and West to the Batavia and Sefton, and the heads of the Archer with its 14 branches; also as far North as the Pascoe and numerous unnamed and unmapped creeks which we crossed, and to the East over 200 miles of coastline.

The climate is healthy and cool, compared to many southern ports; refreshing showers in August and September, and a cool sea breeze blowing through the opening of the coast range. Nature has made beautiful plains fit for man's use whenever he chooses to make use of them; a natural port with easy access to the interior, Mein Telegraph and the outer world.

Thanks to the sandal-wood men and others the blacks are now quiet and workable. The Government might utilise the blacks in cutting inexpensive tracks to unexplored country, which I have no doubt would soon repay them by the discovery of rich mineral deposits.

We continued our course to the heads of the Lockhart, forming central camps in the Valley of Hills. Working from that centre we prospected numerous gullies, ravines, and creeks. The country was most difficult to prospect, as we had to cut through much scrub. Miles of *bamboo*, suitable for furniture making, can be had for the cutting, the work being suitable for the blacks. I have samples.

The Valley of Hills was named by Dr. Jack; this is good pastoral country, and should be called "The Valley of Green Hills," beautifully situated, healthy, within 10 miles of the sea, and in sight of it.

We rounded the heads of the Lockhart and Hay's Creek, diving into a maze of scrub and creeks. Here we discovered a new stinging-tree, different to the ones found in Cooktown; its sting is as painful and lasting as any here. The leaf is long and narrow, with the nettles on the back, rib and edge; the trunk is quite harmless; it grows 10 to 15 feet high in shrubs and trees. The natives have a dread of it, and are quick to push the stem out of the way. There is also a black bird, like a black cockatoo, about the same size, with turned beak, but it has a different call, and travels in pairs. I have never seen it before in the Cook district.

There is a new fruit, new to me, that grows very profusely on the edges of all the scrubs. The fruit grows at the butt, near the ground, and is eaten by the natives. The tree was just flowering when we were there. I tried to preserve a sample of flower and leaf—it is not much good.

Wild bananas like the Cavendish grow in abundance and are of good flavour. I brought some of the seeds.

There seems to be a great scarcity of native *bees*, as I never saw a hive. It would be a good idea to let loose a few hives of English bees to replenish the native food supply, which is not too plentiful. The mango tree and jack fruit should be planted where suitable for them. Some places seemed to be devoid of bird life as we passed through. It seems to be the home of the Cassawary, but they are hard to get near. My dog bailed up the parent birds with young ones, and natives brought us young birds the size of a chicken. Eggs are hard to find. I secured a couple, but had no luck with them. I saw one of the largest scrub hen's nest I have heard of. The measurement round the base was over 120 feet and about 15 feet high, but there were no eggs in it.

The natives call all creeks "Attava," water they call "Peah," porcupine they call "Ralma."

Two pioneer prospectors battled their way on foot from the Rocky Goldfield, named by Messrs. Dodds and Preston, and succeeded in locating a payable reef on the divide of Hay's and Nesbit waters, only 6 miles from the coast. While we were there they shipped to the Towers 36 tons of stone, under many difficulties and great risk. This yielded the satisfactory return of over 7ozs. per ton, worth over £1,000. That and what I have written to the Mines Department proves that the district is worth exploiting.

I think I have said enough to convince my hearers that there is a big tract of valuable country awaiting settlement and opening up. It is a shame to have to allow a big district like this to lie idle for over thirty years without trying to open up a port to facilitate settlement.

The influence of a port would be great and far-reaching, as nature has blessed the country with many advantages and resources, if only aided by Government in starting.

Our last trips were made into the McIllwraith Mountains, and big scrub in the mountains where we found gold in several places, but not payable.

Had we been more fortunate the words "New Rush" would have worked a change like magic, without assistance, and again proved the developing power of the Prospector, who is never or seldom *honoured*.

There are five remarkable and prominent pinnacles on the McIllwraith range, and we got gold behind them. I have named them "Appel's Pinnacles," after the Minister for Mines, in honour of the trip.

Also there is a fair-sized creek that drains a big scrub in the mountains, where we found gold; this I have named "Cherry's Creek," after our Warden, for the help and encouragement he gave us.

MANCHURIA, THE HOME OF THE MANCHUS*

BY E. E. EDWARDS, B.A.

Manchuria—the Tung-san-sheng ("Three Eastern Provinces") of the Chinese—may be described as an agglomeration of petty Tartar, or Manchu, Principalities, lying to the north-east of China proper, and to the east of Mongolia. These were conquered, one after another, and welded into one Kingdom during the 16th and 17th centuries, by a Manchu chieftain named Nurhachu and his successors, who from their ultimate capital—Mukden—made inroads on China, and after a determined struggle, overthrew the great Ming dynasty, captured the celestial Empire, and placed themselves on the throne at Peking in the year 1644. The first of these Manchu Emperors was named Shun Chih; of that dynasty to-day the tenth—Pu Yi—reigns over the vast Chinese Empire. This little all-conquering Manchu nation, led from its mountain fastness by a petty Tartar Chief nearly 300 years ago, imposed on the innumerable millions of its conquered enemies a visible badge of humiliation, but, with rapid transformation, the institutions, language and almost the national entity of the conquerors have now become absorbed in those of the subject race.

While the Manchus were concerning themselves with China, the Russians were making their way to the branches of the Upper Amur River, and settling in the neighbouring regions, which at that time constituted Northern Manchuria. The result was a conflict which resulted in the Treaty of 1689, in which the boundaries of the two empires of China and Muscovy were laid down. Suffice it to say that, under this Treaty, the boundary between Russia and Northern Manchuria was intended to be the Argun and Gorbitza Rivers and the Yablonoi Mountains from the source of the latter river to the sea. By a subsequent Treaty (Treaty of Aigun 1858) the whole of

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the country between the Yablonoi Mountains and the Amur River fell to Russia, and the territory between the Ussuri River (a tributary of the Amur) and the sea was placed under the jurisdiction of both countries, pending a delimitation of the frontier.

Following on further Treaties, in 1860 the boundaries of Russia and Manchuria were proclaimed to be the Argun River on the west, the Amur River to the Ussuri River on the north, and a line from the mouth of the Ussuri to the mouth of the Tumen River on the east. The Amur, Sungari and the Ussuri Rivers were to be open to the navigation of Russian and Chinese vessels only—to the exclusion of the vessels of other countries. Since 1689, however, the whole coastline of Northern and Central Manchuria has fallen bit by bit into the hands of Russia. To-day Manchuria's seaboard consists only of that piece of coast lying between the Ya-lu River and the Chinese province of Chihli.

The remaining boundaries of Manchuria on the east and south-east consist of the Tumen River to its source in the Ch'ang-pai-Shan; a line thence to the source of the Ya-lu River in the same mountains, and the Ya-lu itself to its mouth.

On the south, from the mouth of the Ya-lu to the great wall of China, Manchuria is bounded by the Yellow Sea and the Gulf of Liao-tung.

On the west it is bounded by the Chinese province of Chihli, Eastern Mongolia as far as the Dalai Nor Lake, and thence to the Amur by the Argun River.

Its greatest length from Port Arthur to the Amur is under 1,000 miles; its breadth 600 miles.

Within the boundaries just described is contained an area of some 360,000 square miles, comprising the "Three Great Provinces," known individually as Hei-lung-Chiang (or Tsitsihar), Kirin and Feng-t'ien (or Liao-tung). Within these limits are found a variety of peoples—Manchus and Mongols, Chinese, Russians and Koreans.

With regard to its physical features, it will suffice to say that Manchuria is essentially a highland country, a land of many mountains, large plains and numerous rivers, a number of its waterways being navigable for several hundreds of miles. The mountain ranges are volcanic, and, in many instances, thickly covered with forests. The grass-covered steppes of the north-western province are occupied by Mongols, who there graze their herds. In the mountains and on the steppes large and small game abound, tigers and bears finding cover in the forests; wild animals supply large quantities of furs, which are much used during the intense cold of winter. The forests

contain valuable oak, elm, willow and pine, which furnish Manchuria's great lumber markets. The hills of Feng-t'ien are rich in carboniferous strata, the coal of Liao-yang being said to be equal to the best Cardiff. Gold exists in places, the banks of some of the streams being rich in the precious metal. Iron deposits are known, and in some places are worked in proximity to coal. Quantities of silver are found associated with lead, while sulphur and other mineral springs are scattered about the country. In the numerous mountain ranges fine granites abound.

The climate of Manchuria is extreme ; in summer the temperature may be over 90° Fahrenheit, while in winter the thermometer records 50° or 60° below freezing point. During the winter months the country is ice-bound, being subject in some parts to falls of snow of two or three feet. During this period of the year all water-borne traffic ceases, but it is at this time that the roads, usually consisting of soft loam worn into deep ruts and bad at their best, become frozen hard, and are suitable, more or less, for vehicular traffic. In the winter, when the deep ruts are filled with frozen snow, the roads afford passage to many heavily laden caravans. At this time sledges are in common use for conveying both passengers and goods. But when the snow thaws, the so-called roads become converted into veritable quagmires, and, therefore, are useless for carts and teams.

The population of the three Manchurian provinces is estimated to be about 20,000,000, but, of these, probably not more than ten per cent. are Manchus. Intellectually, the Manchu is the inferior of the Chinese, nor does he possess the business qualities nor the industry of the latter. To-day Northern Chinese is the language of Manchuria, the Manchu language being confined to the more remote parts to which the Chinese have not approached in large numbers. To the inexperienced eye, ethnological points of difference between Manchus and Chinese are hardly discernible ; and the two peoples dress much alike. But with regard to the women, a Manchu can be distinguished at a glance. The dress of the Manchu women is, in the main, very similar to that of the men. The women are distinguishable by their erect carriage and free and untrammelled gait, due no doubt to the natural condition of the feet which are never cramped or distorted. Nevertheless, owing to the thick inelastic soles of her shoes, the gait of the Manchu woman is somewhat peculiar but by no means ungainly. Quite distinctive is the coiffure of the Manchu lady, which stands 6 or 8 inches above her smooth black head on each side of which is a cross-bar wound with loops of black satin. This cross-piece, projecting half a foot, is adorned with flowers, tinsel and jewels.

The Manchu is not by nature an agriculturist; up to the time of the present dynasty the inhabitants of Manchuria were warriors, hunters and fishermen. The soil was not cultivated beyond their immediate wants. Nevertheless, much of the land is exceedingly fertile, and produces beans, wheat, barley, poppies, indigo, tobacco, rice, saffron, etc. But the most important cereal grown in Manchuria is the tall millet known as Kao-liang, which grows 10 or 12 feet high. It not only is the staple food of the people, but it is the principal grain fed to farm animals. From it, too, are distilled spirits, while the stems are converted into fuel or utilised for roofing houses, strewing roadways and conversion into matting. One of the most valuable products is tusser, or wild silk, but it is restricted principally to the province of Feng-t'ien. It is said that not one-fifth of the whole arable land of Manchuria is at present under cultivation, nevertheless, each year many thousand Chinese labourers, principally from the provinces of Shan-tung and Chihli, distribute themselves all over Manchuria and Eastern Mongolia. After the crops are harvested, a large number of these emigrants return to their homes; but Northern China continues to supply Manchuria with a steady stream of colonists.

Next in importance to the Kao-liang or giant millet as an article of cultivation, and of much greater importance as an article of external trade, are beans. Some thirty varieties of the Soy bean grow in Manchuria, distinguished by the Chinese by their colours, e.g., yellow, green, black. Soy beans have great value as food for man and beast. From them is expressed an oil, which is in universal demand in Chinese cookery; the residuum, pressed into great yellow cakes, is used as food for cattle or as a fertiliser for the soil; also for the making of candles, soap, and dog-biscuits. The oil is used as a substitute for olive oil, and bean flour serves as an adulterant for other flours. A preparation known as bean-curd is a great Chinese delicacy We Australians can appreciate the product of the bean when, after long journeys oversea, it reaches us in bottles bearing a label with the name of a celebrated table sauce. Export of beans is increasing yearly, large puantities being carried by native junks as well as by modern steamships. I have seen it stated that in one year (1899) beans, bean-cake, and bean-oil were exported to the value of 75,000,000 American dollars. Since then the trade has increased enormously. While travelling in Liao-tung I gathered a few figures, which will help to give some idea of the huge trade in this produce. On 3rd December last there were stored on the wharves at Dairen nearly 40,000 tons of beans and bean-cake. The same day there arrived at the wharves of this same port about the same quantity to await

export. These figures relate to one single day and one single shipping port.

Mukden, the home of the royal family of the present reigning dynasty, and the capital of the province of Feng-t'ien, is generally known by its Chinese names Sheng-king or Feng-t'ien. Mukden, built on a vast, bare, open, plain at an elevation of 320 feet above sea level, offers a fine example of a fenced, or walled city. An outer rampart is formed of mud, and encloses some ten square miles of country. Within it are scattered the native houses or hovels and garden patches. The city proper is contained within four miles of wall of squared masonry and brick ; this wall gradually tapers to the top, which is 30 feet above the ground, and which is covered by a crenellated parapet, and is strengthened by the usual buttresses. On the corners of the walls stand flanking towers and, in the centre of each side, a lofty fortified gateway, surmounted by a picturesque pagoda-like pavilion several storeys high. Formerly the gates were closed at nightfall. As is common in Manchurian towns, the main street runs due north and south, and the second street runs at right angles to it. Parallel to these main roadways run a series of alleys of more or less importance ; but, owing to the anxiety of everybody to be in the main street, this street is often a mile or two long. Above the one-storeyed houses the city gateways and picturesque pagodas tower majestically, the Manchurian pagoda sometimes reaching 150 feet in height. In the heart of Mukden is a third wall enclosing a palace adorned with imperial yellow tiles. Within the Manchu capital is contained a population which is set down at anything between 136,000 and a quarter of a million inhabitants. The quarter of Mukden in which I stayed was some three miles from the walled city, and also was far without the old mud rampart. A fairly well-made road, but exceedingly dusty, and swept by a bitter wind, runs past a picturesque old Manchu pagoda and a number of temples, and then passes through the mud rampart and under a skeleton metal archway, coloured and ornamented by huge dragons, erected during the early Russian occupation. Four large discs denote the entrance to the boundary of the main city. The large city gateways are striking and imposing ; in comparison the streets have a very primitive appearance. During my stay in this Manchu city the streets were crowded with a busy throng. The numerous shops can boast only one storey, but they are adorned with gorgeous signposts and advertisement boards. Of such signs the finest is that of the pawn-shops, which, in this country, serve as banks. It consists of a lofty pillar fastened between two massive granite blocks, and from the

upper part of it projects the carved effigy of a dragon's head gaily painted and decorated with gilt. In front of the more pretentious shops depend glittering signboards of every colour, shape and design. The Tartar City possesses many picturesque features. The people themselves are picturesque as they parade the narrow streets. Not only is there colour on the carved and gilded shop fronts and street signs, but the costumes of men, women and children are striking in their oddity. In winter every human being appears to be of abnormal bulk, owing to the thick, down clothing and furs which are necessary to keep out the cold. The Manchu women, wearing long robes of brilliant colours, have their faces enamelled a vivid cerise; the whole population, old and young, are swaddled in an abnormal thickness of sheepskins and furs. From the shops project golden sceptres, figures of gods, fiends and various other mythical monsters, while model peacocks roost on high poles; besides these, there are gigantic facsimiles of the goods sold within, e.g., hats, boots and pipes. City life centres around the picturesque mediaeval bell-tower and drum-tower which stand across the streets. Here are the rich silk shops and fur shops. Along the highways mules and ponies strain at the Manchurian cart which trails behind. The long cart is a low, heavy, vehicle to which sometimes six or seven mules or ponies are hitched, one beast being in the shafts, the others hitched two or three abreast. This long cart is used for conveying goods and merchandise. The small or passenger cart is quite a different affair. Two stout planks are joined together by wooden crosspieces. Where they project in front they form the shafts; the projection behind serves as a frame on which to carry luggage. Immediately behind the shafts comes the flooring of the body of the cart; on this the driver sits. Behind him the framework is covered with lattice woodwork circled at the top, and barely four feet high; over the lattice is spread the blue native cloth which, in winter, is lined with cheap fur. The front is protected by a curtain, and in both front and sides there is a small window. Firmly attached to the bottom of the cart is a massive axle-tree supported by two wheels, four feet in diameter, provided with 16 spokes, and kept in position by steel linch pins. The tyre, an inch and a half wide, is of iron half an inch thick, and frequently is so knotted as to resemble a cog-wheel. To lessen the discomfort of this conveyance, which never is provided with springs, cushions and mattresses are strewn on the floor.

Port Arthur—until the war with Japan, China's greatest naval station in the north—is an oval inlet of the sea, some two miles long from east to west, and a mile from north to south, surrounded by

high hills, and entered on the south side by a narrow channel guarded at the south end by a couple of reefs, and protected against storms by a spit of land which runs diagonally across its northern end. A line drawn from this channel to the extreme west of the town, which occupies the face of the hills on the north-east side of the inlet, divides it into two unequal parts known respectively as East and West Bays. The former is small, and has accommodation for a very limited number of vessels, while the latter is much larger, but shallow and unnavigable. The Japanese, however, are deepening this shallow basin. To the east of the town are the arsenal and Government workshops and stores, while on the opposite side of East Bay there is a dock of considerable size. From a central eminence—Monument Hill—one obtains a fine view of the whole of the harbour. To the right stretches the Tiger's Tail Promontory; towards the left is Golden Hill; a prominent feature in a chain of high hills between those two striking features is the narrow "bottleneck" entrance to the harbour. The town itself is divided into two parts by a mole-like formation rising abruptly to the east of the railway line, and now known as Monument Hill. To-day the town consists of three portions, namely the New and Old Towns, and the Chinese quarter.

Port Arthur, for ever famous for its memorable siege, is a natural fortress, the town and harbour being secluded in an amphitheatre hidden from the sea by Golden Hill and the Tiger's Tail, and surrounded by a complete chain of fortified hills. Originally, Port Arthur (native name Lushun) was a Chinese town without walls. At the conclusion of the war between China and Japan, the Treaty of Shimonoseki (17th April, 1895) provided for the cession to Japan, in perpetuity and full sovereignty, of the southern part of Liao-tung Peninsula within which lies Port Arthur; but on representations being made to Japan by Russia, France and Germany, she was induced to relinquish, for a consideration (30,000,000 kuping taels) the fruits of her victory. On 27th March, 1898, the Emperor of China entered into an agreement with Russia, whereby China ceded to Russia for a period of 25 years Port Arthur, Talienwan and certain other Territory. Port Arthur was to be a naval port for the sole use of Russian and Chinese men-of-war. The day after the signing of this convention the Russians occupied Port Arthur, and continued to do so until the place was recently captured by the Japanese. The Russians immediately proceeded to construct railways in Southern Manchuria and to fortify their newly-acquired naval port. Its strong position and great natural advantages were skilfully utilised by the Russians for fortifications quite regardless of cost and labour. The

ironstone forts were further strengthened with every conceivable means of defence work, and armed with the most approved weapons. Communication between the forts was by means of tunnels and sheltered trenches, so that by the time the Japanese drew near the fortress each position had been made unapproachable on account of wire entanglements, mines, etc. The Russians had been unsparing in their efforts to make the place an impregnable base of their operations in the Far East. During this time business flourished and many European merchants, as well as Chinese, found their way to Port Arthur, there being at one time 3,000 European and American residents. To accommodate all these the old town was too small, and accordingly a new town was built two miles to the westward. The enormous outlay for these and other constructions too numerous to mention, easily can be imagined. As I found it, Port Arthur is little more than a fortress; business and commerce seem to be almost nil. Almost all the Russian occupants have withdrawn, but in the streets Russian names still may be seen. The population is about 6,500. Under a monument on a hill-side lie the remains of nearly 15,000 Russian soldiers who fell during the famous siege. On the summit of Monument Hill is a Charnel Shrine, underneath which the cremated remains of some 20,000 Japanese soldiers lie interred. Here, too, stands a monument, 200 feet high, erected to the memory of those who offered their lives in the service of their country during the years 1904 and 1905. On an eminence overlooking the old town is a Museum, containing a magnificent collection of war souvenirs. It is a small, unpretentious building with several shell holes through the roof. In the approach are models of trenches, chevaux-de-frise, wire entanglements, siege artillery, bombs, mines, etc; inside are models of some of the principal forts, swords, bayonets, heliographs, field telegraphs, scaling ladders, types of uniforms, specimens of clothing, foods, and some Russian ladies' satin evening shoes, etc., etc. Everything in and around the museum has a most tragic history. Until recently there were many Japanese blockading ships lying on their sides in the harbour, bearing silent, but impressive witness to the bravery of the Japanese navy.

In 1860, during hostilities with China, the British fleet anchored in a fine, sheltered inlet on the western side of Talienwan Bay. For the next forty years the place (then known as Victoria Bay) was almost forgotten until, in 1898, Russia succeeded in obtaining from the Chinese a long lease of the surrounding territory. The Russians fully recognised the value of Talienwan Bay, and lost no time in selecting it as suitable for an important port. The modern city, named by the

Russians Dalny (Far Away), is now known in the East as Dairen or Tairen. When the Russians leased the place from China in 1898 it was quite a desolate spot, and consisted of only the huts and hamlets of a few hardy fishermen. With remarkable energy, the Russians during the six years of occupation, 1898 to 1904, laid out and built up one of the finest towns in the Far East, with good roads and parks, cathedrals and mansions, wharves and warehouses. The city is situated at the sourthern corner of the Liao-tung Peninsula, and stands on the hill slopes along the shores of Talienwan Bay. Its harbour, which has the great advantage of being open to navigation throughout the year, is well sheltered, and has sufficient water for the largest of steamers. Almost at the outset of the war the town was occupied by the Japanese Army, and served as the principal base of supply. At present it contains a population of 50,000 persons. The trade of the port, both by sea and by land, is rapidly increasing On one day alone—December 3rd, 1910—there were stored on the quays over 45,000 tons of goods. The same day about the same quantity arrived at the wharves. These wharves, which are nearly three miles distant from the heart of the town, can accommodate the largest ocean steamers, and have a frontage of over 3,000 feet. A similar length of wharf can accommodate vessels up to 22 feet in draught. The narrowest of the wharves is of ample width, and all of the quays are laid with railway lines, which facilitate the transport of merchandise. The inner harbour is protected by a stone breakwater enclosing a basin of 500 acres. The wharves originally constructed by the Russians, are lighted by electricity, and the harbour channels by gas buoys. Shipping can enter the port at any time of day, and at any state of tide. Large granite dry docks and repairing shops serve the Japanese navy. The departing Russians destroyed the town and port of Dalny prior to quitting it in the month of May, 1904, and immediately after their departure every house in the "European town" was thoroughly looted by the Chinese. The Japanese found large heaps of costly furniture, pianos, billiard tables, etc., all useless, at the street corners. There were only two days between the time when the Russians evacuated the town and the Japanese entered; during these two days, the Chinese carried away more than 300 cart loads of goods from the European quarter. In the spring of 1904, the population was composed principally of Russian officials, whole streets of houses being tenantless. Since the Russian evacuation, however, the city has been repaired and improved by the Japanese, who, largely by the aid of the powerful South Manchuria Railway Company, whose chief offices, railway works, engineering works and southern terminus are at Dairen, are responsible for the

extraordinary development of this part of Manchuria. When the Japanese entered Dairen they found awaiting them a substantial city, which is reported to have cost Russia something like 20,000,000 roubles. The residential area is laid out strictly on a modern plan, with many fine roadways radiating from centres where spacious circles provide public gardens surrounded by handsome buildings. On either side of many of the principal thoroughfares are planted flowering trees, while miles of good macadamised roads with side pavements have been laid out, and a perfect drainage system has been installed. The city proper is furnished with a fine electric car system, is lighted by electricity and gas and has ample local and long distance telephone facilities. Dairen, is in its construction, truly a European city, occupying a site which thirteen years ago boasted nothing more than a few fishermen's hovels.

ANNIVERSARY ADDRESS.*

By The Hon. Sir ARTHUR MORGAN, kt., f.r.g.s., President.

Ladies and Gentlemen,—

My address to you this evening will be brief, referring chiefly to the work being done in the regions to the north and south of the Australian Continent, which, by reason of their contiguity, possess a special interest for us. I allude to Antarctica and New Guinea, though splendid work is being done in other parts of the world, and much still remains to do. "It has always seemed to me," said the Rt. Hon. James Bryce, speaking a few months ago at the annual meeting of the National Geographic Society of the United States—a society whose members now number 74,000, an increase of 21,000 in the last year—"it has always seemed to me that the one dark cloud on the horizon of our geographers, the one drop of bitter which prevents us enjoying the draught of knowledge which is raised to our lips by every successful geographer, is the sense that this planet of ours is limited, and that in time we shall have exhausted all its resources as far as exploration is concerned." But that time is not yet. It may be quite true that these are no longer the days of the most sensational discoveries. But if we cannot look forward to anything like the discovery of the Pacific Ocean—which it is now claimed was made from the Australian, and not from the American, side—we can at least match the discovery of the North Pole by pushing a few marches south of Shackleton's furthest; and there is still a great deal of geographical work to be done in the South American continent, in Africa, in Sumatra, in the Philippines, in New Guinea, and even in Australia. Projectors of railways and other profit-seekers are pushing on the work of exploration, but there are still ample fields awaiting the scientific explorer, where fame may be won and new and interesting chapters added to the book of knowledge.

Activity in the field of exploration and discovery is now confined chiefly to the South Polar regions. The Arctic areas, though not yet

* Delivered before the Royal Geographical Society of Australasia, Queensland, August 2, 1911.

wholly examined in detail, are sufficiently well known in general outline to be described as fairly familiar to those who take more than a passing interest in the progress of geographical achievement. The North Pole itself has fallen a prize to the United States, and to that nation, as well as to the distinguished explorer, Robert E. Peary, whose labours were crowned with success after twenty years of determined effort, the thanks and congratulations of the geographical world are due. Peary and his no less distinguished predecessors and contemporaries have told us probably nearly everything that is worth knowing about Arctic geography and the physical phenomena of a region that was until quite recently the goal of effort by men of many nations. It may be said with a fair degree of confidence that future exploratory enterprises in that quarter of the globe will be conducted chiefly in the interests of commerce, rather than for scientific purposes. The whaling industry, the fur trade, the seal fisheries, and ivory-hunting will still offer prizes sufficiently rich to tempt those interested in commercial enterprises, quite apart from the excitement and adventure associated with life in the Arctic regions, whose comparative nearness to the great centres of population and industry give them an advantage over the more remote sections of the globe.

In the great Antarctic areas the general physical conditions are altogether different. Animal life is—so far as we know—comparatively scarce, and of insignificant commercial value. Consequently, fewer inducements are offered to the business man for the investment of capital or the extension of industrial enterprises. The region is a region of desolation—of intense cold always, and in certain seasons of continuous gales and snowstorms; and the great ice barrier, extending for immense distances along the shores of the vast and mysterious Southern Continent, will always offer a serious obstacle to attempts to reach the interior. Yet, even in the lonely wastes of those high latitudes—a continent wrapped in eternal ice and snow, the base of mighty mountains over whose summits hang the smoke of volcanic fires, and round whose bases whistle furious winds—even there the British flag has been planted, within 112 miles of the Pole; and there the Empire is worthily represented to-day by Captain Scott and his brave companions, pushing on towards the goal which on a former expedition they sought in vain to reach. Nor are they alone. Several of the great Nations of Continental Europe also have expeditions in Antarctica, and even Asia is represented by Japan in the international race now in progress for the honour of doing in the south what the United States has already accomplished in the north. There is room for all; for friendly rivalry in the field of ex-

ploration and discovery is conducive to the promotion of human knowledge and the march of empire.

Already our knowledge of these far southern fields has been largely increased by the splendid achievements of recent expeditions sent out from England, Scotland, Belgium and France, all of them under accomplished leaders. One of the most successful was the expedition commanded by Sir Ernest Shackleton, which succeeded in locating the South Magnetic Pole, an achievement with which the name of Professor David, of Sydney University, is and will always be honourably associated. Had the Shackleton expedition done nothing more than ascertain the position of the Magnetic Pole, it would have fully justified the honours which have been conferred upon its distinguished leader. But Shackleton's dash for the Pole still stands as the most remarkable achievement in Antarctic exploration, though we are all hoping that Scott will push the bounds of knowledge further yet.

The world has to thank the French explorer, Dr. Charcot, for much valuable information concerning that part of the Antarctic Continent which lies immediately to the south of South America. That is the quarter in which the first land ever found within the Antarctic circle was discovered ninety years ago by the Russian explorer, Bellingshausen, who conferred the names Peter and Alexander on important landmasses. In 1830 Biscoe discovered and named the Biscoe Islands and Adelaide Island, and in 1897 our knowledge of the region was increased by the drift of the Belgica. But it was reserved for Dr. Charcot to connect together all the earlier isolated discoveries, and to show that they were of much greater importance than the discoverers themselves had supposed. The work was taken up by the Pourquoi Pas at the point at which it had been discontinued by the Francais, and pushed further to the south. The desolate coasts of Graham Land and Terre Loubet were mapped out, and the eastern coast of Adelaide Island—which was found to be over 80 miles long—was also marked. Alexander Land was found to be a large island, between which the Adelaide Island is the entrance to a great bay forming a deep indentation in the coast of the mainland. Here and on Alexander Land several important points were fixed, and a good deal of valuable hydrographical work done. Petermann Island formed the winter quarters of the expedition, and the Pourquoi Pas ? afterwards went to Deception Island, which was explored and recharted. Bridgman Island was next visited, and a hydrographical survey made of Admiralty Bay. In the summer of 1909-1910, the explorers on their southern journey sighted a new coast line in about

70° south and about 79° west, but the heavy ice forbade a near approach. Peter Island was also sighted, and the journey continued westward to about 126° west before the ship was placed on the homeward course. The new land, which Dr. Charcot did not name, is a southern continuation of the Graham Land peninsula of Antarctica, and appears to exhibit the characteristic physical features of that land mass. The discoveries made by the expedition tend to disprove the possibility of a southern strait connecting the Bellingshausen and Weddell seas. A great deal of oceanographical work was done, including soundings, surface and deep-sea temperature determinations, deep-sea dredging, and work with tow nets and vertical nets. The soundings showed the western limits of the continental shelf, and revealed the previously unsuspected existence of a depth of 5,000 metres to the south of the Antarctic circle and west of Peter Land. During the winter two first class meteorological observatories were maintained on Petermann Island—one at sea level, the other at 115 feet,—and during the summer cruises observations were taken on board every two hours. In carrying out the biological work of the expedition a great deal of material was obtained. The deepest dredging was in 280 fathoms. Many interesting observations of bird life were made and recorded. By means of labels affixed to penguins it was ascertained that the birds return year by year, not only to the same rookery, but to the precise spot which they occupied the year before.

The "Terra Nova," which left New Zealand in November, 1910, conveying the British Antarctic Expedition, under Captain Scott, to McMurdo Strait, returned to Lyttleton Harbour at the end of March, bringing despatches from the leader. The journey southward was very stormy, and pack ice was encountered on December 6th, in latitude 65°. The pack was so heavy that twenty-one days were spent in pushing through 380 miles of it. The open water of Ross Sea was reached on December 30th, and the vessel arrived at Cape Crozier four days later; but a heavy swell prevented the expedition landing. McMurdo Sound was found to be unusually open, and winter quarters were established at Cape Evans, fourteen miles north of the station occupied by the "Discovery." Considerable difficulty was experienced in landing the stores; one of the motor sledges dropped through a hole in the ice and was lost. After the work of house-building had been completed, Captain Scott, towards the end of January, set off to the south to lay down depots. From this expedition he was expected to return at the beginning of April. On leaving McMurdo Sound the "Terra Nova" proceeded eastward

along the edge of the Great Ice Barrier, but, being unable to effect a landing at Cape Colbeck, she returned to the Bay of Whales, where the "Fram"—the vessel in which Nansen attempted to reach the North Pole in 1893-6—was found, having on board a Norwegian expedition commanded by Captain Amundsen, one of Nansen's old colleagues. Returning to McMurdo Sound, the "Terra Nova" left messages for Captain Scott; then, turning northward again, and dropping a party at Cape Adare, the ship proceeded to investigate the pack in the neighbourhood of Balleny Islands. A mountainous coast-line was discovered in 69° 50′ south and 163° 20′ east, and this was followed in a north-westerly direction for about thirty miles, but the pack prevented a near approach to it. Many interesting soundings were made, and excellent biological hauls obtained. The ship finally left the pack in 64° 23′ south, 160° 30′ east

At first it was announced that Captain Amundsen's expedition had been sent out to do some preliminary oceanographical work in Antarctic regions; but it would now seem that the commander has so far altered his original plans as to contemplate an attack upon the Pole itself. It is asserted that Captain Amundsen, who has with him 115 Greenland dogs and a full equipment of sledges, etc., intends to attempt to reach the Pole by way of the Beardmore Glacier—that is, by the same route as Captain Scott. The "Fram" is now at Buenos Ayres, where she arrived on April 19th; she will again sail south in October to pick up the polar party. A message from Captain Amundsen intimated that he intended to start for the south on the departure of the "Fram." The vessel left the Barrier in February, and it would seem that a winter attempt on the Pole was to be made.

Dr. Douglas Mawson recently delivered a lecture before the Royal Geographical Society in London, in which he outlined the plans he has formed for his proposed expedition to the Antarctic regions. He proposes to employ about 50 men, and to devote his attention mainly to the investigation of a tract of land on the margin of the Antarctic continent.

When Sir Ernest Shackleton went in quest of the South Pole, he established a record in enterprise by taking with him a motor-car. His friend, Dr. Douglas Mawson, of Adelaide, who did such brilliant work on the Shackleton expedition, and who is to lead an Australian Antarctic expedition, intends to excel Sir Ernest in enterprise; he will take with him an aeroplane as well as a motor-car. The machine is to be a modified "R.E.P. monoplane." In other words, it is to be one of the single-deck machines constructed by the eminent French designer, Robert Esnault Pelterie. A large screen will be added to

protect the pilot, Lieut. Hugh Watkins and Dr. Mawson, from the "nipping and eager air" of those latitudes; and a special adjustment of the carburetter and fuel tank is to be devised as insurance against the petrol freezing.

The machine will be employed for map-making and survey work, and also in connection with a final dash to the pole. It will be flown in stages from one to another of the depots established by an advance party. When the depot furthest south is reached, a maximum supply of petrol will be taken on board, and an attempt made to reach the Pole, and return to the starting point in a single flight. It is hoped that, carrying a pilot and a passenger, the monoplane will be able to remain in the air long enough to cover a distance of 250 miles. Truly the progress of Antarctic exploration is advancing by leaps and bounds. A party will be despatched from the main base in the direction of the Magnetic Pole.* The main objects of the expedition are stated to be:—"To survey and map as much as possible of the coast between Cape Adare and Gaussberg; to investigate its geology and mineralogy; to study glaciers and ice formation; to make systematic magnetic observations, especially in the neighbourhood of the Magnetic Pole; to obtain a continuous meteorological record, and test the desirability of establishing a permanent meteorological observatory in those parts; to investigate the fauna of a sea that abounds in life. The scientific problems suggested are numerous and of the greatest importance, and there are others. But the list also shows that Australasia may expect results of practical value, apart from pure science, in return for the expenditure incurred. Two thousand miles of unexplored rocky coast means mineral potentialities that may perhaps prove worth realising; and, if so, the task would be less formidable than the exploiting of the gold-fields of Alaska. A sea known to abound in seals and whales of various kinds holds out hopes of valuable fisheries, especially when it is remembered that at one time on the South American side of Antarctica the trades in oil and furs gave rich returns till they were pursued to the point of extinction. But the most probable source of profit to Australasia lies in the meteorological work, for it is from the icy regions to the west of south that we may look for an extension of our knowledge of Australasia's weather, and of our power of forecasting it; and who shall estimate the value of such knowledge in a country like ours?" It is estimated that £40,000 will be required to cover the cost of the expedition, and of this sum about one-half has been promised, the Australasian Association for the Advancement of Science, the Royal Geographical Society, the Commonwealth Government, and Adelaide,

Melbourne, and Sydney enthusiasts having made handsome contributions to the fund. It is intended that the expedition shall start at the beginning of next summer, and be absent for about eighteen months.

A Japanese Antarctic expedition, under the leadership of Lieutenant U. Shirase, sailed from Japan in the ship " Kainan Maru," in November last, and arrived at Wellington, N.Z., on the 8th of February, proceeding later to the polar regions. It has since returned, and reported that the attempt to land on the shores of the great southern continent was unsuccessful. A good deal of mystery surrounds the expedition, the members of which were until recently camped on the shores of Sydney Harbour, whence it is said they propose to sail southward in the spring, with the object of making another attempt to carry out their mission.

A fully equipped German expedition, under the command of Lieutenant W. Filchner, is now on its way to the south. It is to start from Buenos Aires in October, and proceed by way of South Georgia and the Sandwich Islands to the Weddell Sea. The route has been selected with the object of carrying out oceanographical work on the way. On reaching the Weddell Sea, a base station will be established on the eastern coast as far south as possible, with the equipment necessary for a full year's work. The party to be landed will consist of ten men. Of these, six—a geologist, a meteorologist, an astronomer, a doctor who is also a biologist, with a cook and one sailor—will remain at the station, while the other four set out upon what it is hoped will prove a long sledge jouney into the interior of the continent. Meanwhile, the ship (the " Deutschland ") will return to the Atlantic, to prosecute oceanographical research, and carry out coastal observations. In the main, geographical objects of the expedition are to determine the distribution of land and water, to define the coastline of the Polar continent, and to study the conformation and direction of the ice. Oceanographically, systematic observations will be made of the temperature, the salinity, and the oxygenation of the deep sea levels along certain lines in the Sargasso Sea, in the Brazilian current, and in the high latitudes reached by the expedition. Systematic soundings will also be taken in the Atlantic swell between latitude zero and 10° north, in an area concerning which there is at present no data. In the Argentine basin, and further south, soundings will also be taken. The " Deutschland," the ship chosen for the expedition, was built in 1905, and has been specially strengthened for ice navigation. She carries a " wireless " installation, and a full complement of dogs and Manchurian ponies for sledge

transport. There are besides specially constructed motor vehicles—indeed, it is evident that every care has been taken to make the equipment as complete as possible.

Coming nearer home, it may be of interest to refer briefly to the progress of exploration and discovery in New Guinea. Mr. Walter Goodfellow, the leader of the British expedition to Dutch New Guinea, organised by the British Ornithological Union in conjunction with the Royal Geographical Society, was invalided home in the beginning of the year. He has since published some details of the work of the expedition. The party landed at the mouth of the Mimika River, on the shores of the Arafura Sea, and followed the river up to the mountains at its head. The entire country from the coast to the mountains is difficult; it consists of vast areas of swamps intersected by many rivers, which are swollen enormously by the torrential rains which fall in the wet season. At the head of the Mimika River progress was blocked by the snow-clad mountains, which rise sheer from the level forest lands. The party turned eastward and endeavoured to force its way through the dense vegetation of the swamps. In the first day's journey eastward no less than thirty rivers and streams were crossed. The sudden flooding of these streams may make progress, either forward or backward, impossible for weeks at a time. The dense jungle is another great obstacle. On one occasion it took the men three weeks to hew a track two miles long. The trees are bound together by impenetrable masses of vines, creepers, and thorns, and when these are cut showers of hornets and stinging ants are brought down. The natives of the Mimika region were found to have only stone weapons; they soon perceived the value, and were ready to barter anthropological specimens for the steel axes which the Englishmen used. In each village one old man at least was found whose duty it was to sharpen the stone axes for the rest of the community. The men make the canoes, help to build the huts, fashion weapons, and sometimes hunt or fish—all other duties devolve upon the women, who spend much of their time collecting sago and firewood. A fermented drink is made from the sap of the sugar-palm, and on this the men frequently make themselves drunk. Cannibalism is not practised as a regular custom, but enemies killed in warfare are eaten, and it is believed that raids are occasionally made for the purpose of obtaining human flesh. Of the pigmies discovered by the expedition men only were seen—the women and children were always kept out of the way. The skin of these people is lighter than that of the lowland natives. They were of a low order of intelligence.

On a more extensive scale were the Dutch expeditions to southern New Guinea in 1903-7-9. The latest of these, under the leadership of Dr. Lorentz, was engaged in exploring the Snow Mountains situated to the east of the country traversed by the British party. These mountains are represented on the maps as being an easterly extension of the Charles Louis Mountains. After experiencing great difficulties and undergoing serious hardships, the expedition succeeded in reaching the summit of the Orange Mountains, and ascending Wilhelmina Peak, 15,420 feet above sea level. The members of the party suffered severely from cold, prolonged exposure at high altitudes, and want of sufficient food. Some of the carriers perished. The scientific results of the expedition were of high value. Zoologically, additional proofs were obtained that New Guinea was at one time connected by land with the Australian continent, some of the strongest evidence of this connection being afforded by the fishes found in the rivers. A peculiar feature of one of these was observed for the first time in the male of ***Kurtis Gulliveri***, which takes care of its eggs by fastening them to a hook that grows on its occiput, the eggs being connected by a string. A splendid collection of birdskins (nearly a thousand) was obtained, and over ten thousand insects. Botanically, the work of the expedition showed that in New Guinea transitions can be found from the purely tropical to the alpine flora, although the majority of the plants are of Malayan character. The alpine flora, unlike the Australian forms, has a resemblance to the plants inhabiting the mountains of Java, Sumatra, and the Himalayas. Geographically considered, the south coast consists of an immense alluvial plain traversed by numerous rivers. The trend of the hills and mountains is chiefly east and west. Eruptive rocks were found near Geelvink Bay, but the mountains crossed were of recent formation. The Wichmann Mountains consisted partly of sandstone. No real glaciers were met with, but many traces of their former existence were found. Ethnologically, it was found that there is a real distinction between the Papuans inhabiting the plains near the rivers, and those living in the mountains. The former subsist mostly on sago and bananas, their animal food consisting of pigs, fish, wallabies, cassowaries, etc. The mountain tribes live on yams and bananas, pigs, rats and mice. They are all still in a typical stone age. Their weapons consist of bows and arrows, spears, clubs, and stone axes. The arrows are not poisoned. They wear no clothing—this is true even of those who live above the 10,000-feet-level—and clearly belong to a race free from mixture with other races.

In British New Guinea exploratory enterprise has been fairly active for some time past. One of the latest expeditions was that

associated with the name of Mr. Staniforth Smith, whose prolonged absence from the seat of government was the cause of so much anxiety at the beginning of the current year. Happily, the party returned safely after an extended expedition in unknown country. They claim to have elucidated the physical features of a large area of the Territory to the north-west of the Papuan Gulf, and east of the Fly River basin. The expedition had its origin in the reported discovery of coal in the basin of the Purari River, by which stream it was intended to enter and push to westward of the point reached by the Mackay-Little expedition. A modification of this plan was, however, found necessary, and the Kikori River, west of the Purari, was selected as the place of entrance, the party striking across country from the Kikori to Mount Murray. It was intended to go west, cutting the courses of the Omati, Turama, and Bamu Rivers, reaching the coast at the mouth of the Fly. But the direction of the limestone mountain ranges, and the rough nature of the country compelled the explorers to take a north-westerly direction. In latitude 6° 20′ S. a large river was found, which was thought to be the Strickland; it was running through a gorge 1,200 feet deep, and could not be crossed, so rafts were constructed and used to descend the stream. Rapids were found to extend for 120 miles, and in these the rafts were overturned, and all the impedimenta lost, necessitating a journey of 300 miles through unknown country without tents or other necessaries. It was successfully accomplished in thirty-three days. The river proved to be the Kikori, which takes its rise in the main range of New Guinea. The country was found to be extremely rough, the mountain ranges consisting of huge masses of jagged and precipitous coral limestone, while the valleys were also for the most part covered with masses of coral wedged together. Friendly relations were established with and assistance obtained from the natives. A variety of physical types were met with, indicating an admixture of various stocks, some being light in colour, like the Samoans, and others resembling the coastal types. Sago formed the chief food of the natives up to 3,500 feet, and above that level sweet potatoes; wild pigs were everywhere plentiful.

Time will permit of but the briefest mention of the journey of scientific research into the centre of Western New Guinea, made by Dr. Moszkowski, by way of the Mamberamo. The first attempt to ascend the river resulted in a catastrophe, but a second proved more fortunate. Dr. Moszkowski reached a point within twenty miles of Mount Carstensz before being forced to return. The collections which he made were nearly all lost during the descent of the rapids

And now, ladies and gentlemen, my address is ended, and with it closes my term of office as your President. Permit me to conclude with the hope that even heartier support than has been given to me may be extended to my successor, and that under his presidency our society may continue to increase in numbers and usefulness.

AN EMPIRE BUILDER AND HIS WORK, CECIL J. RHODES IN SOUTH AFRICA.*

BY HON. F. T. BRENTNALL, M.L.C., *Fellow.*

The scope of our review to-night brings us into contact with a man whose soul was above trivialities. Cecil John Rhodes was a son of an Anglican clergyman. But no small parochial area would have afforded scope for the breadth of his racial aspirations, or for his loyal ambitions.

With the history of South Atrica, prior to Mr. Rhodes coming on the scene we are not now much concerned. His advent on South African territory was a turning point in history, an epochal event. Without doubt he went to seek fortune for himself. He took with him some strongly-formed British prejudices, and some well-developed British predilections. He was a branch of a tree of ancestral patriotism, of which the roots had struck deeply into English sentiment. He wanted room to grow ; he was an Englishman ; but he was more ; he was a Briton through and through. He came to recognise vividly and sturdily that England was a part of Great Britain, and that Great Britain was the throbbing centre of a vast Imperial ideal, and the seat of an expanding Imperial power. To him the British Empire was a Heaven-given trust, to be used wisely and honourably, to be guarded valorously, and to be extended whenever the best interests of his country or humanity could thereby be promoted or conserved. At an early age his strong intellect had become thoroughly imbued with two sentiments—British patriotism and human progress. Without being fussy, vain, or ostentatious, he was a pushful man ; a thoroughbred Britisher, with plenty of impulsive force in him.

He received a liberal education, and was keen on acquiring knowledge and culture. Even after he had acquired pace in his pursuit of fortune he returned to Oxford year after year, to study for the

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* Read before the Royal Geographical Society of Australasia, Queensland, October 4th, 1911.

degree which he won. In view of the strenuous colonial life which he afterwards lived, this eager pursuit of an educational ideal may seem a bit anomalous, but it showed high aspiration, resolution, and perseverance.

Barely seventeen years of age when he left England for Natal in a sailing ship he was a youthful stripling, with no indication of the physical vigour and burliness which he attained in later life, but with the spirit and courage of a full-grown man. On 1st September, 1870, he stepped ashore at Durban, and trod the soil of a small British territory on the east coast of South Africa. The war of European races had already begun on that continent. Intruding Dutch from Cape Colony had tried to acquire possession of that fair and fertile bit of country known as Natal. Although only in his teens the youthful period of Cecil Rhodes' life had ended. He had left all juvenility behind him.

The second division of his life was a period of vicissitudes in many ways, but in spite of stupendous obstacles he pursued his arduous way to fortune, power and renown. He was richly endowed with natural ability, self-possession, and intentness of purpose. The throb of manhood's vigour was in him. In large measure he had the special qualities which make the grit, grasp and growth of material success. After rebuke and repulse, his natural force quickly rallied. Small adventures were not in his line.

In commercial probity he was robust. He scorned the mean and petty arts of the mercenary schemer. In his case success in life was not achieved by discreditable methods. The phlegmatic slowness, and the subtle equivocations of the prominent Dutchman who became his rival must have vexed him. Once only did a suspicious shadow fall on his reputation for honourable inter-racial and political methods. Under the irritation caused by the obstinate racial prejudices and proclivities of a wily and astute opponent, and by the unjust and arbitrary means by which that opponent sought his ends, he allowed himself to be involved by implication in the initiatory stages of a rash and compromising vindication of rights. For a time it changed some of his co-workers into adversaries, and cooled the ardour of some of his friends. It left a reproach on his great character, and a stigma on his great career. The best of men cannot easily escape the effects of dangerous blunders. In this case Rhodes' very error was the fault of his foresight—his prescience, his eagerness, and the outcome of his justifiable vexations at the unfair treatment of his compeers in Empire-building. His great plans of territorial extension were obstructed in ways that were intolerable to himself

and his coadjutors. They saw manifest danger ahead. They were so eager for progress that the impeditive and subversive tactics of rivals wore down their patience. Thence came the Jameson raid.

Cecil Rhodes had some characteristics which to many people would seem peculiar, if not eccentric. He was a taciturn, self-contained man ; often silent, self-absorbed, and introspective. He had protracted moody abstractions. His reflections were not like cultivated flowers, visibly displayed ; but like tuberous vegetables, the best part of them being underground, in a maturing process. He did not put the best of his thoughts, or of his qualities, or the attractions of his schemes, behind transparent glass windows. But behind his moody silence there was, as amongst the earth strata around his beloved Kimberley, wondrous wealth of precious things. Think of him sitting on an upturned bucket, acting as detective on working Kaffirs, himself sorting diamonds out of the drift ; all the time looking as if his wits were wool-gathering, while really he was brooding over plans for helping, by means of some of those brilliants, to fill the empty spaces of South and Central Africa with a more energetic and progressive race than the austere and lethargic Boers. Longfellow's secret had profound meaning for him :—" Learn to labour and to wait." Beneath an imperturbable demeanour there was a vivacious imagination. He would dramatically spread his hand on a map of Africa and say, " All Red."

In 1894 he was entertained at a banquet at Cape Town. It was a demonstration of protest against the querulous censures on Rhodes himself by some little Englanders of that era, in the old country. The company at that feast comprised representatives of all existing political parties in South Africa. Replying to the toast of his health, he spoke of the time when he first mooted his big projects for occupying and utilising the northerly portions of South Africa, keeping open a trade route, making communication rapid and easy by telegraph and railroad, he said :—" You must remember that in those days everyone was against me. You must remember that when I pointed out to the House that our hinterland must be preserved, I could not get a vote, not a single vote ; and I had to persevere in the face of the greatest difficulties. I made the seizure of the interior a paramount object of my politics, everything else was subordinated to that. I knew that Africa was the last uncivilised portion of the Empire, and that it must be civilised." About four years later, at a general election, he said :—" I think I am justified in saying that had it not been for myself this country would now form a portion of the Transvaal, and it is for you to judge whether you are better off

under Her Majesty's flag, with all the advantages accruing from the extension to the North; or whether it would have been better if you had become an integral part of the Transvaal Republic. But I do claim that owing to myself, to a great extent, the map has been changed."

With all Cecil Rhodes' vast enterprises, executed with sagacious tact and courage; with all his enormous material and financial achievements, there was no vacillation in his loyalty and patriotism. The expansion of the Empire to which he belonged was the fundamental object and aim of all his stupendous enterprises. His brains and his money were used for that object. Large was the stage on which he had elected to play the stirring drama of his adult life. In South Africa his genius found scope for its widest enterprises. There he could use, for the expansion of the Empire, the force that was stirring his brain and blood.

But on that great stage of romantic glamour and rousing inspirations there were other actors, rivals in ambition for territorial expansion. Many of them were his predecessors in occupation of South African territory; they claimed prior rights and persisted in their claims. To none but themselves did they admit rights. The struggle for paramountcy between British and Dutch was severe and protracted. The Transvaal Government conceded most reluctantly and scantily to even the civic rights of so-called outlanders. Firm in self-opinion, strenuous in self-assertion, intolerant of rivals or competitors, they never yielded a point that was arguable; mostly they declined argument on contentious subjects. "When Greek meets Greek then comes the tug-of-war." When the stubborn President of the Transvaal met the Imperialist Rhodes, it was a collision between stolid churlishness and bull-dog tenacity. Metallic mentalism on the one side, British oak on the other; neither will bend nor break under ordinary strain.

In his youth the heart of Cecil J. Rhodes was heated by the flame of patriotism. He came into the active life of England when international strife was widespread. Ten years after his birth British guns had bombarded forts of Japan. His young ears tingled with the startling reports of clashing arms in the Indian Mutiny. Abyssinia was invaded, and Magdala pounded with shot and shell. Cannon smoke was in the distant air. Such events were calculated to stir the blood of any loyal English youth. The grandeur of Empire seized his imagination; nor was he averse to the dreams of personal wealth and influence. His outlook stretched far; his ambition soared high; but his stoutest longings and his loftiest soarings were for

the supremacy of Great Britain in Africa. How eagerly he longed for a distinct redline of territory from the Cape to Cairo! But his eagerness was frustrated by the supineness of one British Government after another. Germany appropriated slices of country on both the east and west coasts of South Africa, and in the far north intercepted the trade route so eagerly coveted by Rhodes.

The chief opponent of Cecil Rhodes in South Africa was Paul Kruger, President of the Transvaal, a taciturn man of reserved temperament. From under the masked battery of sullen reticence he sent forth ordinances of oppression and aggression.

He was one of those stubborn specimens of humanity who cannot be either convinced or persuaded against their will; who cannot repress jealousy and suspicions of rivals, who are always able when it suits their purpose to keep their closed lips well set. Argument and appeal avail not. When the ingredient of race-hatred, is combined with self-interest, all flexibility vanishes from their spinal column. When the friends and advisers of a man of that mould are of the same disposition as himself, inspired with similar ideals, imbued with identical racial prejudices, and are prepared at all hazards, even by brute force, to maintain the rigidity of their position and disposition, then the electricity of conflict is in the air.

It is appropriate at this point to indicate two or three of the considerations which doubtless fortified Paul Kruger in his determination to expand the boundaries of his territory. Within those boundaries, could he keep quiet, he was safe from aggression and annoyance. But he coveted property which belonged to his neighbour. To obtain that property he relied on material help from Europe. In January, 1895, at a banquet in Pretoria, in honour of the German Kaiser's birthday, Kruger made a speech that told much of his hope and confidence of help, in case of need, from the Germans. In addressing those present he said, "I know I may count on the Germans in future, and I hope Transvaalers will do their best to foster the friendship that exists between them. I feel certain that when the time comes for the Republic to wear larger clothes you will have done much to bring it about." We all remember the cablegram sent by the Kaiser to Kruger after the discomfiture of Jameson's reprehensible raid, and the ill-feeling provoked in England by that unfriendly act. The speech at Pretoria had important and speedy results.

In accordance with the terms of a Swaziland convention, President Kruger shortly issued a Proclamation assuming the Government of that territory. He desired this as it would give his people access to

the sea. His object was frustrated by the prompt annexation by the British Government of the whole of Amatongaland, which lay between Swaziland and the sea. For once the British Foreign Office was equal to a Colonial emergency. Expansion of territory was the President's ideal. He detested British supremacy. In 1881 he pleaded earnestly with President Brand, of the Orange Free State to join forces with him. "Freedom," he said, "shall rise in South Africa as the sun from the morning clouds, as freedom rose in the United States of America. Then shall it be from Zambesi to Simon's Bay, Africa for the Africanders." It was a great aspiration. Fine country was to be found between the river Limpopo and the Zambesi. It is part of the country to which our great colonist's name was afterwards given, Rhodesia. The area of Rhodesia is 711,010 square miles. The total area of France, Prussia, Austria, Great Britain and Spain only exceeds that of Rhodesia by 57,490 square miles. It will, perhaps, convey a better conception of its extent and value if I say that our own State comprises 670,500 square miles, or only 59,490 less than Rhodesia.

Think of it! Less than half a century back all the territory actually held in South Africa by Great Britain was Cape Colony and the small but beautiful and fertile colony of Natal. Two tiny patches of red on the map of South Africa! For the possession of Natal she had strife for eight years with the intrusive Boers. The Dutch coterie which surrounded President Kruger propounded an organisation of men of their own race in Cape Colony, the Orange Free State, and Natal, in addition to the Boers in the Transvaal. To this organisation was given the generic designation of "Africander Bond." This bond's motto was "Africa for the Africanders." Its object was to secure for their own race as much as possible, if not the whole of South Africa; to wrest the dominancy of that part of the world from Great Britain. This was no secret. It was a manifest anti-British movement.

Let us recall the fact that on 20th December, 1880, a detachment of British soldiers in the Transvaal was attacked and destroyed by Boers. Early next year the Boers invaded Natal. Several conflicts followed. On 28th January following the British force was beaten at Laing's Nek. A month later came the disaster of Majuba Hill. It was only a small battle, but its issues were important. It was a turning point in South African history. Our troops were out-matched, they had neither the fighting skill nor the fighting stamina of their opponents. As marksmen they were far inferior. Nor were they well officered. Their officers lacked promptitude and

resourcefulness. The enemy then, as in later emergencies, was underrated.

Here it may be noted that it was an unfortunate fact for British standing in South Africa that at that period the colonising sentiment beat feebly in the hearts of British statesmen. This arose partly from a desire to be at peace with other nations; partly from a dread of overweighting the mother country with far-away responsibilities of protection and defence. In "Reminiscences of Goldwin Smith," recently published, he says, "Just now (in 1895), the particular cry against the Manchester School and its memory is that we were anti-colonial, and wanted to get rid of the colonies, a base design in which we are triumphantly told we have failed, after being tantalised by a near approach to success. To get rid of the colonies, as it would be highly criminal, is happily impossible, the relations between the Mother country and a colony being one which can never be annulled. To promote colonial independence was our aim, and a great step towards it was made by the completion of colonial self-government, and the withdrawal of troops."

Again and again went urgent appeals from Britons in Africa to London for annexation of territory ere the chance should pass for ever. Owing either to disinclination or dilatoriness, some valuable areas did pass into the possession of powers who never manifest any ardent regard for our nation or for its interests. Penalty mostly follows the loss of prestige and renown, and it is most aggravating when it results from weak purpose or dilatory action. Once in a letter to a London correspondent, Mr. Rhodes wrote:—"I desire to act for the benefit of those who, I think, are the greatest people the world has ever seen, but whose fault is that they do not know their strength and their greatness and their destiny." Once Disraeli who by the irony of altered circumstances, became an Imperialist, in a letter to the Earl of Malmesbury spoke of "these wretched colonies as a millstone round the necks of British statesmen," and predicted, possibly with hope, that in a few years they would all be independent.

After the humiliating reverse on Majuba Hill on 27th February, 1881, the Transvaal, by decision of the Gladstone Government, was retroceded to the Boers. This action as a matter of sentiment was admirable, as a matter of policy deplorable. By Dutch, Germans, and natives alike the easy vanquishment of British soldiers was regarded as martial inferiority, and throughout the British Empire it produced profound shame and humiliation. This was the penalty which Britain paid for its amiable concessions to its enemies.

In 1881 Cecil J. Rhodes was elected to the Cape Parliament, just a month after the disaster at Majuba Hill. He was then a young adventurous digger. He experienced some of the ups and downs of mining adventure, but he finally got on the up grade and rose to fortune. Thoroughly imbued with British sentiment, as he was, the reverse to British arms must have distressed him. But he could be self-restrained. No sign of mortified depression was seen in him. On April 19th he delivered his first speech in Parliament. A Parliamentary reporter wrote of him :—" A fine, ruddy Englishman, a jovial-looking young squire. His speech was blunt and untutored in style, with no graces of oratory. A candid friend remarked that he would be a Parliamentary failure. But though then boyishly nervous, and even uncouth in gesture, he became a most effective speaker in the House, without ever being eloquent. He could hit hard, and delighted in the joy of combat."

He was even then a man of moody silences. He was a day-dreamer. His mind was more active than his tongue. He brooded over great projects. But his dreams were neither vague nor fanciful. His far-away gaze was on distant positions of individual influence and national power, which should yet bring to himself and his country, the latter especially, the achievement of a glorious destiny in that part of the world. It was about that period that he again spread his hand over the map of Africa and said :—" That is my dream, all British." He was not insensible to the difficulties that lay in his way. Heed his own words :—" When I first entered on Cape politics two conspicuous factors weighed with me. One was the constant vacillation of the Home Government, which never knew its own mind about us. Many Englishmen cried out at the surrender after Majuba, bnt the real humiliation was borne by those who, relying on the Imperial pledges, had stood firm in the Transvaal for the old flag. That was one factor, but there was another. The English party in the Cape Assembly was hopelessly divided and individually incapable; and it had no policy beyond that of securing office. On the other side was a compact body of nominees of what afterwards came to be called the Africander Bond, who acted all together at the dictation of Hofmeyer, the most capable politician in South Africa. I had a policy of my own which I never disguised from Hofmeyer. It was to keep open the road to the north, to secure for British South Africa room for expansion, and to leave time and circumstances to bring about an inevitable federation."

We might now consider in detail what the thoughts and aims of this dreamer were. The discovery of the Diamond fields in Griqua-

land West opened up a theatre for great events in politics, industry, and warfare. A store of enormous wealth was found there, but of wealth often comes strife. It did here. Rhodes, and many others, had found their source of fortune. What will he do with his? He was no miser, no niggard. He went to South Africa to seek fortune. Beyond the dreams of avarice he made money there; made it rapidly, abundantly. Freely out of Nature's lap he received; freely he gave to promote the good of humanity, and the stability of his great country. He was deeply impressed with a belief that in their ultimate destiny the great need was new territory, fit for the overflow population of the old country to settle on permanently. He wanted to stretch out east, west, north. He strove to live at peace with the Dutch, and work with them in a friendly spirit; for he recognised that they were the most numerous, and had a vested right in their occupation of the soil."

South Africa (like our own Australia), was a country of vast spaces, mostly occupied by native races, who were actuated by savage instincts and impulses, and knew naught of sycophancy or cowardice. They were bellicose by nature, and the thirst for blood was as strong in them as in the wild beasts of their forests. These, unaided, could not ever have made the best of the country they owned. Like most barbarians they were frequently engaged in invading each other's territory, marauding each other's property and destroying life. When they dared, they treated white men in the same way. They knew that the whites coveted their possessions, and sooner or later would despoil them. Land hunger had seized on these whites like an epidemic. But the records of South Africa testify to the passionate devotion of the natives to their country. It was their heritage, Nature's endowment, their Home-land. For it they yelled and shrieked, as they plunged into the wild conflict, to fight, bleed and die in defence. Never can be erased from those annals the deeds of blood with which are associated such names as Seccocoeni, Lo Bengula, Moshesh, Dingaan. Who can condemn them for the patriotic vigour with which they defended their lands and cattle from seizure?

Kruger's objective was:—Britain ousted; all South Africa under Dutch sway. At the same time our great Englishman was saying to himself and to his trusted friends:—"From the Zambesi to the Cape, all red." In 1881 the Boers, jubilant after the Majuba victory, were given by a Convention at Pretoria, their full limits of territory; but that did not content them. The Hon. Sir Lewis Mitchell attended that Convention. This gentleman has written a "Life of Cecil John Rhodes." After the Convention had closed he had a conversation

with the President of the Orange Free State, who informed him that overtures had been made to him to federate the two Republics. In Mitchell's Life of Rhodes (Vol. 1 p. 126) the writer says :—" The bait held out to him was his election as President of the Federation. To an ambitious man the prospect would have been alluring ; but Brand was a patriot and not merely a politician, and he declined the proposal without hesitation. ' We are very well as we are,' Brand said, ' we may be poor, but we are safe from attack. We are surrounded on three sides by British power, but at least we are free. The Transvaal is only a protected State, and it has ambitions which I do not share.' From that day onward until his flight from Pretoria because of the expected arrival of Lord Roberts the President of the Transvaal never ceased to struggle for an extension of his borders."

But he had a resolute competitor, a man of many parts, with a genius for civil statesmanship. There was general unrest. Although in 1867 Moshesh, in his old age, had asked for a British Protectorate against foes of his country, there was disquiet in Bechuanaland ; Basutoland also was often a scene of hostilities. In 1882 General Gordon came as a peace-maker. In that year there were stirring events ; but no encouragement came to General Gordon from the Home Government. In August of that year he wrote :—" It is, I think, abundantly clear from public despatches and private information that Her Majesty's present advisers (the Gladstone Cabinet) will leave Basuto affairs severely alone, and I doubt if they would intervene to save the Basuto people from destruction." He added that " he feared that an abandonment of the country would only pave the way to a struggle between the European and native races on a very extensive scale."

Gordon visited Masupha, an inferior Basuto chief ; the result was a Suzerainty over his dominions, with a British resident. Gordon was a strong man bound. Despairing of being of service there he left South Africa on 16th October, 1882. After his departure there came trouble with Bechuanaland. The Transvaal Boers coveted it. They started filibustering expeditions against Zulu and Bechuana territory.

In the same year President Kruger visited England. A convention in London sent him back inflated with pride. Peace at any price seemed to be the British motto. With one exception everything, even the British suzerainty, was yielded to the Boers. The only remaining fragment of British control was a power of veto on Boer treaties with foreign countries. Kruger's people soon showed their despisal of British weakness. Before many months had elapsed they were intruding into Zululand and Stellaland. This was an affront

to British magnanimity. It roused a retaliatory spirit; a rare manifestation in those dilatory days. Dutch residents in two countries in which the lands had, by chiefs, been put under the protection of Britain now claimed independence under the designation of "The New Republic." Could arrogant effrontery have gone further? It meant war. Sir Charles Warren soon brought The New Republic to its right position; but the flaccid anti-colonial incertitude of the Home Government recognised the New Republic with a reduced area of territory. In 1888 it was absorbed by the Transvaal. As a compensatory balance the British protectorate over Bechuanaland was extended. The scramble for South African territory was then becoming lively. Great Britain was slowly moving north and east. Men on the spot were urging the Home Government to annex land adjoining the Cape Colony on both its sides. Some of those appeals were passionate, but the don't-care phlegmatism of the British authorities was almost immovable.

Germany stepped in with the connivance, if not at the instigation, of Paul Kruger. He preferred Teutonic to Anglo-Saxon neighbours. On the west coast there was a piece of country containing an area of 320,000 square miles. The area was imposing, and the position was enviable. The British Government turned a deaf ear to Sir Bartle Frere's earnest appeals for its annexation to Cape Colony. On 16th July 1884, the Cape Government formally put in a claim for it, but the supine Government in London delayed, and before the Cape could confirm its claim by actual occupation the German flag was hoisted at Angra Pequina, and with the exception of Walfisch Bay the whole of Damaraland and Namaqualand became a German colony. This colony has no suitable port. Walfisch Bay, the only practicable port, had been previously annexed to Cape Colony. Within a fortnight of the German annexation President Kruger showed his preference for Germans by giving to a syndicate of men of that race and his own, exclusive right to construct railways within the Transvaal Republic.

It has been well said (by Arthur W. Jose), that "While the British Empire is maintained by the strenuous devotion of innumerable citizens, it has been built by the unconstrainable genius of a few." Cecil John Rhodes was one of those few. For a dozen years at least he was the central figure in South African history. Others there were of prominence and influence who strove for power. He was foremost and greatest of all, but strove less for personal aggrandizement than for the strength and glory of his mother country. Once, at Windsor, Queen Victoria asked him:—"And what are you doing in

Africa, Mr. Rhodes?" His reply was:—"Extending your Majesty's dominions, madam." It was on the same occasion that he gave a witty and gallant reply to another guest. "They say, Mr. Rhodes, that you are a woman-hater. I hope it is not true?" The prompt reply was perhaps somewhat evasive:—"How could I hate a sex to which Her Majesty belongs."

Like most men of strong self-dependence and conscious will power, Rhodes made enemies. It is not common for extreme suavity to be combined with resolute vigour of self-will. C. J. Rhodes was in front of many daring enterprises. Occasional failures and frequent rebuffs did not take the heart out of him. He had associates who esteemed and trusted him as their leader. He was early on the diamond fields of Griqualand West. When he saw a fair chance of fortune he pounced upon it. When Witwater's Rand sounded the golden note of a new discovery he was quickly there. He rapidly made a fortune out of mining. Much of what he made easily he spent generously. He was intent on acquisition. His agents obtained from Lo Bengula a concession of all mineral rights in Mashonaland. Other native chiefs offered to sell the Protectorate of their respective territories. Rhodes was always ready to negotiate with them. Bargain after bargain was secured by him. The various concessions thus obtained were consolidated on equitable and just terms, and became the property of a powerful company organised by Rhodes and his friends, which became known afterwards as "The British South Africa Company." In 1889 it received its charter from the British Government over the Sign Manual of Queen Victoria. The preamble of that Charter recites:—"We, by our Prerogative Royal and of our especial grace, certain knowledge and mere motion, have constituted, erected and incorporated and by this Our Charter for Us and Our Heirs and Royal successors do constitute, erect and incorporate into one body politic and corporate by the name of The British South Africa Company, the said James, Duke of Abercorn, Alexander William George Duke of Fife, Edric Frederick Lord Gifford, Cecil John Rhodes, Alfred Beit, Albert Henry George Grey and George Cawston. . . . And we do hereby accordingly will, ordain, give, grant, constitute, appoint and declare as follows (that is to say) the principal field of the operations of The British South Africa Company shall be the region of South Africa lying immediately to the north of British Bechuanaland, and to the north and west of the South African Republic, and to the west of the Portuguese Dominions."

This territory, at first "loosely and inaccurately described as Zambesi," was popularly recognised as being essentially the result

to the British Empire of Cecil Rhodes' sagacious enterprise and indomitable perseverance, and by universal consent, to it was given his own name, Rhodesia. The year after its incorporation the Company occupied Mashonaland, and firmly asserted and stoutly upheld British claims there against demands of Portuguese and Dutch. In 1890, President Kruger and the British High Commissioner met at Blignant's Pont. The President was then informed that his aspirations, like his plans, for possession of Swaziland must fail. It had been secured to Britain. A convention was prepared. At first the Transvaal Executive Council declined to confirm it, but afterwards yielded to necessity. On 6th October, 1889, Rhodes was a guest at a banquet at Mafeking. He had recently heard that the Zambesi had ceased to be the northern boundary of his acquired territory. It was still stretching northward. His Company's possessions had been enormously increased by a cession of land and mineral rights over Barotseland.

The map of Africa was under-going rapid changes. To a large extent Rhodes' desire to see the map of South Africa all red was being realised. But Germany had striven to thrust areas of territory from both the East and West coast to the boundaries of the Transvaal for the manifest purpose of crossing, between them, the entire breadth of the continent and barring Britain's way to the north. The intention failed them; it has more conspicuously failed since the Boer war. Now, from Cape Town to the north of Rhodesia, 2,400 miles, the centre of South Africa is "all red." Rhodes desired a red line right through from Cape Town to Cairo. But for the anti-colonial prejudice which prevailed in Britain he might have got it. But other European countries, taking advantage of Britain's supineness stepped in and thwarted his aims.

In 1889, after infinite trouble and exemplary patience and perseverance, he succeeded in securing an approved right, for which he paid £10,000, to enter into possession of Matabeleland. This was not fully approved by Lo Bengula's people. Two of his Indunas undertook a mission to London, where they were made much of; were breakfasted by the Aborigines Protection Society, and had an audience of the Queen. After much irritating negotiation the concession was confirmed. In quiet assurance Rhodes was marching on to glorious achievement. His matured plans were being realised in spite of official slowness and delay at Imperial headquarters. It was then he formed the British South Africa Company, with a capital of one million sterling, to which his own Company, "De Beers Consolidated," subscribed £200,000. This De Beers Company was

formed by Rhodes to work the best of the mines on the Diamond Field of Kimberley after he had by selection or purchase acquired them.

In that year he became Premier of Cape Colony, a position which he retained till January, 1896. Then, in a spirit of profound humiliation, he resigned after the ill-advised and Quixotic escapade of Dr. Jameson and his armed associates who, on the 28th December, 1895, left Mafeking to invade the Transvaal. The Empire-builder fell into a dark shade, and abode there for some time. His was a great reverse. During the year 1895 he fell from the pinnacle of honour and fame into the pathetic depths of suspected dishonour and self-abasement. On 1st January, 1895, he was made a Privy Councillor; on 31st December of the same year occurred the defeat of Jameson's raiding column. This rash impulsive action, provoked by Kruger's disregard of the rights and amenities of civilised life, beclouded Rhodes' later life, but was perhaps less his fault than that of others less self-restrained.

Although under some stigma and much suspicion, this man of daring action held tenaciously to his primary object, and pursued assiduously his idea of a great Federation in South Africa of all territories held by Britons or Boers. This consummation, so devoutly wished, he was not destined to accomplish by peaceful methods of diplomacy. Wider and wider yawned the chasm of separation between the loyal subjects of Queen Victoria and the subjects of the two Dutch Presidents. The rival ambitions for national prestige and power of the two persistent leaders removed them farther apart. This rivalry gave impetus to the vigour with which Rhodes hurried along his own projects. His eyes, and his thoughts behind them, turned ever to the North. But that futile Raid caused turmoil in his soul and his life.

Seven days after the Jameson emeute had collapsed Rhodes, with his friend Beit, left Cape Town for England. After a brief and busy stay in London he left for the Continent of Europe on 10th February. He arrived at Beira on 20th March. After a lengthy interview with the Portuguese Governor of the Province, he proceeded to Umtali, thence to Salisbury. Here he heard of outrages and menaces by the Matabele. He recognised that a crisis was at hand. His old energy became revivified in presence of danger. In less than ten days he was on the march to Matoppo Hills with 150 men, and arrangements were made for Dr. Jameson to meet him with 140 police. A reply telegram from Buluwayo said:—"Much more serious than you think. To go into Matoppos with less than 500 is madness."

Many striking incidents occurred during this campaign. These cannot now detain us. Rhodes was himself again. He was in the thick of fight, valorous and fearless as ever. The struggle lasted for eight months. At Buluwayo he said:—"My policy will never change. I should be a very small man if I altered, through recent trouble, the ideas of a life-time." These are the words of a man with a set purpose in life. No cringing under adversity, no croaking at reverses, no white-feathered poltroonery. The genuine man appeared when, at Buluwayo he said, "You have done me the honour of calling this country by my name. My return for that will be to make the country as great as I can."

His work of extension and consolidation was not yet complete. He meant to run the telegraph line through and beyond Rhodesia. The construction of the railway was a greater achievement, for it had to be prosecuted against opposition. Its extension to Buluwayo was a great accomplishment. It was built with South African money. It has now bridged the noble Zambesi. To make practicable the gigantic projects of this masterly mind it was necessary that Mashonaland, should be annexed to Rhodesia. Its area was 73,000 square miles. It lay on the route to the north which Rhodes had mapped out in his own mind. "Its occupation," says a recent writer, "must ever be regarded as one of the most venturesome feats accomplished by men of our race during the Victorian era."

But Rhodes' plan was to go for bigger game than that. He desired to cut a straight route to Buluwayo itself. But that meant fighting. A powerful and alert obstructionist strode defiantly across his path. The fierce and ever ready warriors of Matabeleland, with the ferocious Lo Bengula at their head, menaced his progress. But he had determined that the Goshen they owned must come within the zone of British civilisation. It would require a strong host of wild barbarians to break his resolution, or divert his purpose. The mettle of his spirit was that of men who march to conquer. At that time the ruler of the coveted land was far-famed for his martial prowess and sanguinary exploits. But, for the present more cautious counsels prevailed, for the South Africa Company could scarcely muster enough armed men to encounter Lo Bengula's 20,000 trained warriors.

For a dozen years past men of other races had cast envious eyes on native territories to east, west and north. In 1887, Kruger had tried hard to secure reversionary rights in Matabeleland and the remote interior. In the same year Germany was desirous of having a cut of that pie. About that time Cecil Rhodes said, "My aim in life is to secure a country, by its soil and climate fit for white

habitation, and which may prove suitable for British occupation. That is my ideal."

Of the following year his biographer says, " The time had arrived to strike and strike hard, if he was to win in his struggle with Kruger for British supremacy in the far north. Although the boundaries of the Transvaal had been repeatedly delimited, and were again settled by a convention signed at Pretoria on 11th June of this very year, the Boers had never frankly abandoned their hopes of adding Mashonaland and Matabeleland to their dominions." But on 30th October, 1888, a formal Indaba was held at the Kraal on the Indusa River. Much debating and talk took place on the subject of conceding many rights over the King's territory to certain applicants. After two days this massive monarch of iron will and blood-thirsty spirit chose the British for his friends; seized a pen when many eyes were upon him and affixed his mark to a very formal and precise document, by which he assigned, on exact conditions, to three " Grantees jointly and severally the complete and exclusive charge over all metals and minerals in his kingdoms, etc." Subsequently, that convention was sold for shares equal in value to one million pounds sterling in the British South African Chartered Company.

Having briefly sketched the character of this remarkable man, having indicated how by the use of the sterling qualities of his nature, he had in an amazingly short time won an ample fortune for himself and a large portion of South Africa for his native country, it is with regret that many interesting incidents in his career have had to be omitted and others cursorily treated. But to show the nature of the country which he had to traverse in his arduous pursuit of the great objects of his life I must quote somewhat. Leaving the port of Beira on 26th September, 1891, with a considerable native retinue, he proceeded in a flat-bottomed boat up the Pungwe River. The description of the voyage up the river is rather startling. The travellers anchored at night in mid-stream. " They found it difficult to sleep owing to the concert kept up by lions and hyenas on both sides of the river, while by day the low islands and mud flats were seen to be swarming with crocodiles, and the river itself with lumbering hippopotami. When the river route was left for the road the travellers met with herds of buffalo and zebra." The arrival of Rhodes at Umtali is thus described in " The Adventures of Two Hospital Nurses in Mashonaland." " His stay was not to exceed two days, so we did not expect to see him. Great was our astonishment when on the morning of the 10th October one of the officials rushed in breathless

to say Mr. Rhodes was coming. He rode up alone. His appearance and Roman Emperor type of head are too well known to need description. As soon as he was seated on a box in our hut he asked for pen and ink, saying he would give us something for the hospital. How much would we have? Would £100 do? 'Make it £150.' If we had asked £500 he would have given it. Everything about the man is big,—faults, virtues, projects. We were especially charmed with the great man's simple manners. He was beseiged with petitions of all sorts. Malcontents and chronic grumblers went to his hut and came away cheerful and satisfied. Not that anything was altered in the condition of affairs, the man's personal magnetism wrought the change."

This is the way great careers are made and honourable fame is won. This was a man of heroic action, whose formula was,—"The great secret of life is work." In 1896 this grave man of grave affairs had many weights on his spirits. In the first half of the year he had a critical encounter with the fiery Matabele who strove hard to repel all claimants and dispel all encumbrances on their lands. In May of that year the promoters of civilisation gathered in great force at Buluwayo. In June the Matabele were joined by the warriors of Mashona. Fighting was strenuous in many parts. Rhodes exposed himself to the enemies' fire. The struggle lasted most of the year. The cost was borne by the Chartered Company. When peace was at length won it was more by patient diplomacy than by rifle and maxim gun.

Many chiefs had hid themselves in the wilds and fastnesses of the Matoppo Hills, which were 70 miles long and 30 miles broad. It was a favourite resort of Cecil Rhodes. There he waited for the submission of the rebel tribes. One after another he induced them to come and see him. He waited six weeks for the chief Babwan. On the lofty Matoppos he won his greatest victory up to that period. When all was over, and he was trekking south, at Salisbury he disbursed £10,000 of his own money in charity, among natives who, by the recent war, had lost all they possessed.

In due time this man of high purpose and persistent vigour emerged from the odium which the reckless raid had brought upon his potent name. By his judicious silence, his well-directed energy his undoubted patriotism, he put to shame some of the hasty revilers who were too blinded by envy or malice to understand him, or his policy, or his methods. Deserted by some of his craven friends, reviled by rancorous opponents, traduced by mean men who could not estimate the moral power and purity of his staunch and candid

nature, he had to endure a load of care without abating a jot of hope or purpose.

This year, 1896, was the one in which four of the ringleaders of the raid were tried and sentenced to death. But owing to a powerful movement for a reprieve the sentence was commuted to a fine each of £25,000. Oom Paul was a lover of gold. Towards the fines Cecil Rhodes contributed out of his own funds the large sum of £62,000, In 1898 he visited England. During that journey he rallied from his depression, and when back in South Africa returned to Parliament. On August 22nd the thoughts and hopes of his sanguine mind found vent in the Assembly. "As for the Transvaal question," he said, "I am perfectly clear that, as I have said before, there is going to be no bloodshed. If Kruger is a sensible man he will climb down in the end, and there will be a settlement. The less we deal with that question in this House the better. Many of us have been burnt over it. Many say the Transvaal must be an English-speaking community. Once the settlement is over, we shall be better friends in South Africa."

In that instance his sagacity was at fault. He miscalculated the Boer disposition. It was not then peaceable, not friendly, not reconcilable. Munitions of war had been surreptitiously pouring into the Transvaal and Orange Free State for months past. In seven weeks after the delivery of Rhodes' hopeful speech Kruger's ultimatum was issued, and he gave only two days' grace. He, with all the arms he had smuggled in, was ready, and forthwith his drilled marksmen were marching to the invasion of British protected territory. After Cronje's surrender this telegram from Kruger was found in his laager at Bloemfontein, "I trust my Free State brothers will not allow Rhodes to escape out of Kimberley. Your brothers on this side the Vaal are standing firmly and watching. May God help us to cast off the yoke of the English for good. For this purpose we offer, with God's help, property and blood."

When the news that war had been threatened reached Cape Town, with all possible speed Cecil Rhodes hurried away to Kimberley, where for 18 weeks he was engaged in the defence of that wealthy town against the investing Boers. Writing of his self-denying heroism there a Glasgow newspaper said, "Mr. Rhodes' services during the siege are scarcely yet appreciated at their proper value. In big things, as in little, it was he who kept Kimberley together. He himself equipped four-fifths of the garrison, and his soup kitchen daily fed 10,000 people."

That Boer war hastened his end. He now lies in his self-chosen resting-place on Matoppo Hills He loved that beautiful locality.

Once he prostrated himself on the grass to feel what lying there was like. Sir Lewis Mitchell being present on the last night of his friend's life says,—" I sat for a while by his bedside. He was restless and uneasy. Once he murmured, ' So little done, so much to do,' and then, after a long pause, I heard him singing softly to himself, maybe a few bars of an air he had once sung at his mother's knee. Then in a clear voice he called for Dr. Jameson. I slipped away to my own house a few miles away. Within an hour came the fatal telegram that the greatest of modern Englishmen had passed away."

NOTES FROM MY AFRICAN LOG.*

BY E. B. HARRIS.

Twenty-five years ago communication with the East Coast of Africa was maintained principally by way of Aden. The Mail Liners from Europe called there, transhipping cargo and passengers to a branch line running down to Kismayu, Am, Mombas and Zanzibar. These steamers were small, obsolete, and low-powered, only steaming eight to ten knots, and as their run was entirely within tropical waters it was impossible to keep them free from the numerous African insect pests which cause so much personal annoyance, so passengers found conditions in the small craft very trying after the comforts of the larger vessels, although after all it was only giving them a very diluted taste of what they would have to encounter when they entered the conditions obtaining amongst the Arabs and Natives, with whom they would come into contact ashore.

The East Coast is a dangerous one. Even in fine weather there is always a big heave—a long swell—while during the monsoons, very heavy weather is encountered. A peculiarity of the coast is the erratic nature of the currents. The Admiralty charts are annotated with warnings " current runs from 2½ to 4 knots, direction uncertain " —which renders it most difficult to set a course, especially after dark. There are no lights on this coast to assist the navigator, so that after sundown progress is a good deal a matter of guess work.

On one occasion, when running down the coast, as at dusk the current was setting us in towards the land, the captain wisely hauled off a point or two. When dawn broke we were found to be 60 miles off the land—which we did not pick up again until 12 noon—the current having changed in the night and carried us out to sea. It can easily be imagined what would have happened had the current been setting us " out " during the afternoon, and then after dark

* Read before the Royal Geographical Society of Australasia, Queensland, July 1st, 1912.

changed and run strongly "towards" the shore, as then the probability is that ere dawn we should have found ourselves piled up on the beach.

On another occasion, when at Mombas, we were looking for the "Capurthana," the steamer from the North, from Aden, bringing the mails from home, but she did not appear on her due date. Next day, to our astonishment, she was sighted steaming up from the South, her master explaining that in the night, the current, which had been against him, unexpectedly changed and swept him far South, for when morning broke he found he had been carried past his port. This was not at all an uncommon experience.

Arab seamen have a novel way of navigating at night—they hug the shore and steer by the sound of the breakers—if the noise grows too loud, the dhow is hauled off a bit, if the beat of the surf is lost, they edge in until they pick it up again, but such a form of navigation is far too risky for the European Commander.

I have no doubt that the large steamer "Fifeshire" recently stranded, a total wreck just south of Guardafui, when No. 3 lifeboat was lost with all her complement of passengers and crew, overran her distance, owing to a sudden and unexpected change of current after dark, which carried her into the breakers, when by all computation and previous experience she should have been well out to sea and safety.

Nowadays the point of departure for the East Coast is largely from Durban by the fine Union Castle steamers, and by a good German line.

The ports of East Africa are well worth a visit, not only for their present attractions, but also as viewed from their connection with past history.

It is a curious thing that the clash of arms of the Crusades still echoes through Africa. At the close of the Third Crusade, Richard of England arranged a truce with Saladin and left Palestine, when, except for spasmodic attack by isolated parties, hostilities were suspended for 20 years. The year following Richard's departure, Saladin died, upon which civil war broke out between his sons and his brother, Malik, who each claimed the throne. In the end Malik was victorious, but "peace brought no peace," for the disruption of the considerable forces of Islam which had gathered to defend the Holy Land, lead to domestic disorder, and as in the case of the great contests in Europe—the Seven Years and the Thirty Years Wars—and exactly as I have often heard my father say existed in England at the close of the Napoleonic wars—when large bodies of troops were suddenly disbanded, companies of starving soldiers roamed the

country, pillaging for food, committing all manner of outrages on peaceful subjects.

The restless Bedouin tribes, now more unsettled than usual by the historic events in which they had just participated, showed but little disposition to quietly disperse. Malik, unlike that dominant leader, the Sultan Saladin, found it no easy task to enforce order, so to provide an outlet for the more enterprising Sheiks, he encouraged them to fit out raiding expeditions which harried the coasts of Persia, the Red Sea, East Africa and elsewhere, to such good purpose that they returned laden with plunder and slaves. This well served the policy of Malik, who then projected an expedition on a much more comprehensive scale. It was to be led by his dangerously ambitious Nephew, whom the Sultan desired to see safely out of the country, as his machinations and plottings were a source of alarm to the Throne. The objective was the East African littoral, where it was proposed to make a permanent lodgment. A large fleet of sea-going Dhows set sail, the fierce Riders of the Desert crushed all opposition, and soon the coast lay at their mercy from roughly what is now the southern boundary of Somaliland down to Mozambique. Zanzibar was made the Capital, the victorious Arab invader becoming the first Sultan.

From that solid beginning spread the existing wide influence of the Arab in Central Africa, for they gradually forced their way inland until they held sway over vast districts, and became the controlling power in a huge and lucrative trade, principally in slaves and ivory.

From these Arab adventurers, whose presence in Africa appeared to be, almost, if not entirely, the result of the Crusades, descended the men who, under the comprehensive term of the Mahdi and his Dervishes largely comprised the forces which Kitchener met and defeated at Omdurmann, a repetition of the deadly struggle of 600 years previous between the Crescent and the Cross, an aftermath of the Crusades, which could not in its vaguest form have ever occurred to Richard of England or Godfrey of Jerusalem when they led their mail clad squadrons to battle with the Moslem.

When the great migration from Arabia took place, the invaders carried with them not only their own national arms, the lance, bow and scimitar, but also other weapons taken from vanquished enemies, Persians, Syrians, the Templars and Hospitallers, so amongst the Arabs of East Africa I have come across Persian and other Asiatic arms, Crusaders' double-handed swords, beautifully chased daggers, portions of body armour and suits of chain mail, harness worn say by Western Knights at the disastrous Battle of Hattin, when, for the time, Saladin broke the power of the Christians in the East.

When in East Africa I obtained from an Arab a good specimen of an Asiatic weapon, a Persian horseman's battle-axe, light in weight, easily swung by one hand, the long ebony haft enabling the horseman to comfortably reach his opponent on foot.

Despite the centuries which have elapsed since the Crusades, and the inevitable intermingling of races in most parts, the Arab is still largely pure, and I was surprised at the fine appearance of their handsome strong visaged chiefs. I once attended a palaver, at which some 200 Arab Sheiks were present, and was amazed at their uniform magnificent physique. The majority were men of imposing stature and carriage, much taller than the Europeans present, while those of somewhat lesser height, but still quite the equal of the European in inches, were strongly framed, of deep chest and muscular development, so that physically, man for man, in every respect they were the superior of us who considered ourselves their betters, their fearless eye and bold arragont mien showing that the uncurbed combatative spirit of the desert was still there, and as ready as ever for strife, the latent antagonism of the Moslem for the Christian.

Centuries after this armed invasion of Africa, followed the more peaceful entrance of modern Nations by their agents, German, Belgian, French, British, who each strove to secure a footing with a view of opening up the country to foreign trade.

For instance, various agents made proposals to the Sultan of Zanzibar to " lease " certain specified stretches of coast with their respective hinterlands, guaranteeing fixed revenues to the Sultan, while his rights and authority were to be recognised by the flying of his blood red flag, and the presence of El Wali, his Arab Governor, with a supporting armed force in the various forts and castles.

Meantime, much confusion and conflict in the Zanzibari Littoral arose between Arab, Native, British and German traders, but ultimately a company was formed in London by a number of merchants, shipping men and financiers, termed the I.B.E.A. Co., when it became my fortune to see something of British methods of colonising administration.

By this time the Germans had got their grip on extensive holdings to the south, which put an ending to the unseemly bickerings between British and German agents.

The British venture was to be a second East India Company, to work on similar lines only modernised, but, unfortunately, there was not a Clive or a Warren Hastings at the head of affairs. As is often the case in such matters as this, the leading executive men on the spot were much handicapped, for the members of the Governing

Council in London had numerous protegees, who were considered quite good enough for such a wild little known field as the Zanzibari coast, so positions were "made" for them in the new company, they were sent out in numbers, and unqualified and unfitted as they were, were appointed to important posts. Troubles of all kinds were practically courted, money was constantly required to keep things going, much of it was wasted by inexperienced officials, although in fairness it must be said that all were not incompetent, for many able men served on the company's staff. In all the I.B.E.A. put £750,000 into the venture, in addition to the absorbing of all earnings and profits from caravans, customs, etc., but by 1895 at the end of 11 years, being disinclined to risk further capital, which, was then urgently required, they relinquished the entire adventure, accepted £50,000 from the Sultan of Zanzibar, and £200,000 from the British Government as a retiring allowance, and having sunk £500,000 capital and all profits in a badly worked scheme, withdrew from the coast.

One of the difficulties with which they had to contend was the pronounced hostility of the insubordinate Arab chiefs and the slave traders, who far enough inland to be beyond reach of their Sultan's arm were a law unto themselves. They naturally strenuously objected to their unlicensed methods of raid, pillage and oppression being interfered with, and often showed fight. The Sultan of Witu, a hideously brutal villain, who, with several hundred savages and outlaws of like character, ravaged with fire and blood as far as his sword would reach, selling his captives for slaves, mutilating and murdering those who resisted, soon came into conflict with the I.B.E.A. He attacked and levied blackmail upon the company's caravans, so that the company were forced to take energetic measures to protect themselves. Before these were complete the Sultan, supported by a body of the Masai, marched for the coast to wipe out the white man. I was mustered in with other Europeans to defend Lamu, but when five marches distant he heard that we were too strong, so he fell back to his own country. Presently, when the company had completed preparations, an expedition was sent up country, the Sultan was strong in numbers, his men fanatical and reckless, his capital formidably entrenched. The British were no doubt plucky enough, but were undisciplined, enervated by their past objectless life, unfamiliar with jungle fighting, and in no way hard or seasoned enough for such work. They met with an unfortunate reverse, which naturally was a serious matter, as not only did it confirm the Sultan in his opinion of his own strength and invincibility, but other

malcontents, and the nomadic tribes took heart and became increasingly aggressive. The end was that the company had to confess themselves unable to enforce order within their own borders, and were obliged to invoke the aid of the Navy, which promptly responded; a strong landing party was put ashore from Admiral Fremantle's British East India Squadron, under the command of Captain Curzon-Howe of the Flagship "Boadecia" and Captain Lindley of the cruiser "Blanche." The Sultan, by no means dismayed, mustered his fighting men, and took stand in his strongly stockaded principal town Pumwani. The gates, which were barricaded by thick heavily built barriers of great trees and enormous logs filled in with earth, were first battered by a field gun, then assailed by a storming party of seamen led by a Navy Bos'n, who shattered them with charges of guncotton, the gun and rocket section next shelled the town, when, the way being cleared, with one British cheer the entire force charged the defences, carried the breach, fought their way in, defeated the Sultan, scattered his followers and destroyed the town, but not without loss, for the toll of British wounded was seriously heavy. A few days later the Bluejackets stormed and destroyed another of the Sultan's towns, called Jongeni.

That formidable race of nomads, cattle-raisers and cattle-raiders, the Masai, encouraged by the prevailing state of unrest, took to the war path. They also held up the company's caravans, one attack being on a caravan passing through the Kedrong Valley, led by my friend, Alexander Dick, of Glasgow, a nice quiet fellow, an honourable man, but entirely unfitted for such a position, an example of the way in which disaster was courted by failure to have the right man for the work. In this encounter Dick was killed.

The Masai are fine, fearless fellows, splendid fighters, well built, lithe and sinewy, numbers of them standing 6 feet high. Their arms are an oxhide shield, three or four Pangahs, a spear and a simé. Arrayed in battle line in skins and feathers, leaping as they come to the charge, they present a most picturesque appearance, their height accentuated by their tall head dress.

When within reach they hurl their pangahs—a kind of small heavy club or throwing stick, of hard, polished wood, having a large head at one end—this weapon is nicely balanced and throws well and accurately. For the first clash with the opposing line the spear is used, usually kept in the hand, but occasionally thrown. The last weapon to be brought into play is the curious simé (sword) which is peculiar to the Masai, taking the form of an elongated, narrow leaf widest at the cutting end, tapering towards the hand grip, no cross hilt

I obtained a Masai spear from a member of Stanley's Expedition, which I met at Zanzibar, where Stanley had just arrived after bringing Emin Pasha out of Wadelai.

The expedition had a brush with the Masai, when some of the latter were knocked over, their weapons being brought down to the coast by Stanley's officers.

The value of this spear in the Masai country is a bullock. It is entirely forged from fine iron wire which the native smiths, the Wandorobo, heat, hammer and weld until they produce these handsome well-balanced spears.

It is a disgrace to the Masai warrior to lose his weapons, so it is not easy to obtain good specimens, consequently, quite apart from their associations with Stanley and Emin Pasha, the simé and the spear are much valued by me.

The Zanzibari coast, as I saw it, was most instructive and but little known. In order to give first hand impressions as to how things appeared to me, I shall now refer to my African Log of nearly a quarter of a century ago, written on the spot. So what I am about to say does not by any means apply to the present moment, for under British influence, conditions, especially in sanitation, have vastly improved on the East Coast.

Of the seaports the most important are Zanzibar, Mombas, and Am. The first-named is ill-built, having gradually grown without uniformity or method from a small assemblage of native huts to a densely populated city of 100,000 inhabitants. There is only one at all decent thoroughfare capable of taking wheeled traffic, although a rude tramway runs through streets only 4 feet wide, the crookedness and narrowness of all other arteries making the city hot, oppressive and insanitary, the nights being especially exhausting, so still and dead.

The native town is a labyrinth, a perfect maze of narrow, dirty lanes or alleys, in which I invariably lose my way, never emerging where I wish. Thousands of huts, densely inhabited, scantily lit and ventilated, heavily thatched, are crowded together without any semblance of order, banana trees growing closely in any odd corner. None of the so-called streets in this quarter are capable of taking vehicles, the contracted alleys, often only 2 feet wide, making traffic difficult. In many places, in order to pass, one has to turn sideways, back to the wall, while the other pedestrian, sometimes a sick, dirty native, edges by. In these narrow gutters for they are nothing else, all refuse from the dwellings is thrown, fruit skins, hut sweepings, plantain leaves, vegetable scraps, debris of collapsed buildings, for

nothing is ever removed—as a thing falls so it remains, mango seeds, rags and every other conceivable substance all trampled into one mass, sometimes feet in depth, so that in many instances the floors of the huts are much below the level outside, and there it all lies, rotting in the sun and rain of a tropical country, exhaling abominable odours. The bare feet of the natives tread it down in the centre until it is much like the letter "U" or "V." The roofs overlap, there are no gutters, the equatorial rains pour off from roof to roof, deluging the wayfarer in the footway beneath; there are absolutely no sanitary arrangements, no scavengers, no sewers of any kind, everything goes into and remains in the alleys, so in times of storm one splashes through a small torrent of a foot or more of semi-liquid horror.

Swahili carriers, both men and women, buffalo, camels and donkeys, are the beasts of burthen, and when they pass along the bazaar, i.e., the streets (!) of the business quarter, their loads brushing the walls on either side, their drivers, or the carriers themselves, sing out to clear the way, upon which the pedestrian makes himself as thin and small as he can and at the critical moment recedes into a doorway, or under a clump of bananas, or if he be caught and cannot escape, ducks beneath the pannier or bale. As the ground slopes upwards at the sides, one sets one's heels as firmly as may be to avoid slipping down into the central channel, but more than once have I seen a native come to grief. Hampered by his own load his foothold failed him, and despite his frantic efforts to keep upright, his heels gradually slithered down, until exactly at the critical moment of the arrival of the animal he subsided with a squelch into the unmentionable. No matter what happens, no heed whatever is given to the parlous position of the fallen wayfarer, neither beast nor carrier ever halts or gives way, but on they march, calmly trampling the unhappy wretch into the evil morass and pass on their way. After all, generally not much damage is done, for owing to the general sponginess of the track, the native is just softly squeezed down, the surrounding matter rising up round him. It is quite exciting, when, in the wider lanes, a supercilious camel comes padding along, his load filling the entire width from wall to wall. He is too lordly to notice anyone else, so with a great crush and confusion buffalo, donkey, Swahili carrier alike have to put about and make for the nearest exit. The pedestrian, cautiously gauging the height of the load, meekly ducks as the great beast stalks past. I received a few knocks at different times, but, fortunately, so far, have not been swept off my feet. When about to load up, the packer enquires the destination, the width of the

intervening alleys through which he has to pass, governing the spread of the load.

Zanzibar stands first in importance as the commercial entrepot for the East Coast, and an enormous trade is concentrated here. Strangers are amazed at the sight of the busy anchorage, the rendezvous for warships of many nations, the Sultan's yacht and his own naval force of gunboats, European and Asiatic steamers, Arab dhows, and all kinds of native craft, the captains' gigs from the British, French, Dutch, German and other cruisers looking especially smart as they pull through the fleet of lighters, boats and cargo craft near the shore, a comprehensive scene which puts to shame the sights at many a more well known port. So commanding is the position held by Zanzibar, and so universal the acknowledgment of her pre-eminences not only on the coast, but also far inland, that an Arab proverb say, "When you play on the flute at Zanzibar all Africa as far as the Lakes dances," and yet despite all this not a newspaper is published in the city.

Ivory is one of the most valuable of the exports. The distinguishing terms "live" and "dead" are applied to the different classes of tusks. "Live" is that chopped out of the newly-killed elephant. "Dead" is that found by the natives in the forests and jungles, rotted out of animals which have died from old age—in fight—or stricken by the hunter, wandered away and died of their wounds. From lying in the damp, steaming vegetation it becomes stained and injured by borers, when naturally it is of reduced value.

The finest ivory, and by far the largest quantity comes from East Africa by way of Zanzibar. India produces a much less quantity. Ceylon practically none. For two centuries past most curious fields of fossil ivory have been worked in Siberia, in a manner almost like the mining of coal measures. These tusks have been left by what must have been a perfect holocaust of prehistoric animals, mammoths and such like, and though brittle, broken, and partially decayed, they are still of commercial value, and readily sell in that ivory market of the world—London. Of the total world's yield only 20% is "live," 80% being "dead" and fossil.

The universal sjambok of Central and Southern Africa is usually cut from the hide of the Rhinoceros and Hippopotamus, but good tough young E.A. "live" tusks of sufficient length are so resilient that elastic flexible sjamboks are cut from them. A most shocking waste of valuable material.

Ivory ranges in price from £1,000 to £3,000 a ton; 60lbs. weight each is an average, such tusks roughly weighing 10lbs. to the foot in length. The finest known examples are:—

A tusk 8 feet 7 inches long, weighing 165lbs., presented by the city of Zanzibar to King George when he was Prince of Wales.

The longest pair, measuring 11 feet each, 300lbs. total weight, owned by Roland Ward and Co., London.

The heaviest pair, sent home from Zanzibar in 1898, weighing 450lbs.

In the port scores of boats and lighters are fully occupied, for the Sultan tolerates no wharves, a shattered stone Bunder near the British Residency being the sole landing place on the foreshore.

I witnessed the official landing of Colonel Sir Charles Euan-Smith, the British Resident, his suite, and Lady Euan-Smith. Escorted by the boats of all the assembled cruisers and a multitude of other craft, they pulled in from the anchorage, but the man-o'-war cutter conveying them grounded off the Bunder. Sir Charles, a big imposing man in full uniform, with all his decorations, was fully conscious of his own importance and dignity, and as making an official landing perched on the shoulders of a big Swahili would have been the reverse of edifying, and as Europeans have to ceaselessly remember that making oneself ridiculous before the natives does more to impair the white man's position and authority than anything else, and as also Lady Euan-Smith flatly refused to be carried, a plank was hurriedly sent for, and laid from the Bunder to the gunwale of the boat. The bluejackets jumped into the water and gave a steadying hand on either side, Sir Charles statelily stepping ashore with such presence as he could command. Then Lady Euan-Smith safely negotiated the landing, but just as one of the officers, a captain, put foot on the plank, a swell lifted the boat, the plank tipped and down came the officer across the gunwale nearly breaking his ribs. He had to be ignominously carried ashore, knocked out of the proceedings at the very commencement.

Cargo and passengers alike are carried through the accumulated debris of condemned and rotting slave dhows, and a mixture of all kinds of wreckage, decaying vegetable matter, and the varied collection of refuse which covers the beach, out to the lighters and small craft for conveyance to the bigger vessels at the anchorage beyond. Zanzibar is on the west, the inner side, of the island of the same name on which it stands, and betwixt it and the main land opposite lies a perfect network of 20 miles of sand banks across which the ocean tides sweep, with a rise and fall of 14 feet, nearly three times the average rise of the Brisbane River, so that navigation is intricate and dangerous. The island is most productive, horticulturists would be delighted

with the tropical jungle, with the beautiful varieties of fruit trees, mangosteen, cocoanut, papaw, durian, pomegranate, lychee, many of which grow wild. The mango trees are really magnificent, tall, wide-spread, finely grown, bearing wild, out in the jungle, the most delicately coloured fruit I have ever seen, orange, green, yellow, pink, crimson, more gorgeous than any wax models, the fruit luscious in the extreme.

Cinnamon, nutmeg and clove grow luxuriantly—Zanzibar being the garden of the world for cloves.

This spice was discovered in the East Indies by French explorers, and was by them named "clou"—a nail—from its likeness to a clout nail, short stem, flat head. It is the unopened flower of an evergreen shrub 30 feet to 40 feet high, bright red when picked, but drying to the dull brown familiar to us. It has an overpowering odour and causes temporary blindness to the Swahili pickers. When slavery was in full force, the Sultan was easily enabled to enforce service, but now, under the gradually spreading conditions of freedom, much trouble is experienced in securing pickers. The clove gardens are the glory of Zanzibar, exotic and magnificent; one reads of the spicy breezes of Ceylon Isle, but they are insignificant in comparison with the scent of the Zanzibar spice gardens, the delicate aroma of the blossoms perfuming the whole of their surroundings.

Ninety per cent. of the world's yield of cloves comes from Zanzibar and Pemba. 10 million pounds weight at least being exported yearly, often much more. Of course, this enormous quantity is not consumed solely as spice, large consignments being used in the manufacture of oil of cloves. A heavy export duty of 25% on the export value is levied by the Sultan, and represents a considerable item in his revenue.

Not far from the beach, watching over the anchorage, stand the Sultan's Palace, the Harem and the Clock Tower. Some damage was done to these when the British Fleet, under Admiral Sir Harry Rawson, lately Governor of N.S.W. shelled the Government buildings in 1896.

It is difficult for the order loving Briton to understand the universal pestiferous conditions, the squalor, dirt, confusion and neglect which exist under Arab rule, but apart from the insanitary aspect already mentioned, other features appeal to one's humour. At a particularly busy time, the Sultan's warehouse, i.e., the Customs bonded store, being unequal to the demands upon its space, a consignment of 200 cases of brandy and whisky which had just arrived, was stacked on the balcony of the Sultan's Palace. I looked at it and wondered what the stay-at-home Londoner would think if he saw a consignment of spirits housed under the portico of Buckingham

Palace, or at the Sovereign's entrance to Windsor Castle. The Sultan's "Old Junk Store" is in full view right beneath his Palace windows, in it is heaped a confused mass of old ship's cannon, mounted and unmounted, carriages falling to pieces, wheels broken or missing, guns of brass, bronze, iron, some rusty, some clean, with and without carriages, of all ages and sizes, limbers and ammunition tumbrels, shell buckets, interspersed with ancient condensers, winches, boilers, masts, buoys, anchors and maritime gear of endless variety. Nearby on the Palace verandah stands a battery of light field guns, brass Napoleons, for a wonder in very fair condition.

The port is full of noise, the musical performances commencing at 6 a.m., when the Arab day begins, being constant and varied. Guns from the warships, bugle calls from Consulates, Palace, and men-o'-war, the striking of musical gongs and clocks of which there is a small host—the quarters and halves seeming to come every five minutes, the striking of ships' bells, shout of carrier, boatman, and seller of food and drink, firing of rifles and cannon ashore, playing of the Sultan's and the various senior naval officers' bands, with, to close the Mahommedan 12-hour day, which ends at 6 p.m., the cry of the Muezzins from the Mosques, and a loud confused clang and din of all the bells, bugles, clocks and rifles going off together, to welcome the cessation of toil.

Entrance to the principal Mosque is through a deep Moorish archway leading into an inner courtyard, in which are palms, ferns and tropical shrubs interspersed with fountains standing in large stone basins, where the devout lave hands and feet before entering the Mosque for prayer. On any especially sweltering day it is pleasant to shelter there, sitting on the side of a basin for a few minutes, the splash of water, song of bird, the shade and rustle of trees making it a peaceful, restful place, a welcome change from the crush and discomfort of the bazaar. Zanzibar is entirely unlike Port Said, where there is a constant stream of visitors to the Mosques, so at first I was met with sullen scowls, but later the devotees became used to seeing me, and I received no insults.

A feature of the city is the "Stone Ship." Close by the Harem is a fine spring of water, to preserve the purity of which the Sultan built over it in concrete a model of a steamer some 150 feet long, with the correct hawsepipes, mouldings, stem, forefoot, deadwood, rudder, propeller aperture, all in order and in proper proportion; the height of the side is about 10 feet, and when I jumped and hauled myself up to look, I found it was full of delightfully clear water. It stands in a kind of shallow dock, surrounded by a low stone wall,

at intervals pipes fitted with taps project through the ship's sides, beneath each is a large marble slab where the natives stand and wash themselves.

The slave trade dies hard. British cruisers patrol the coast and capture many slave dhows, but numbers escape, and ashore slaves are always to be had. Some were sold in the slave market just now, while I was here. Outside the city I saw a string of slaves on the march, each with an iron collar round his neck attached both front and back by iron chains to the neck collars of the slaves ahead and astern; they had to keep an accurate step as a regiment of regular soliders, as any irregularity of movement by one gave such a jerk to the collars of the others as to abrade the skin and cause much pain. One day I passed a little slave boy of about 10 years of age with iron bands round wrists, ankles and waist, chains being led from the loin band to all four extremities, so that he could not run, so had no chance of escape.

Just recently an armed boat from the cruiser "Reindeer" captured an Arab slave dhow, the "Mansuri," with 150 slaves aboard, who were released and landed at Zanzibar. All the men were prisoners of war, captured at a recent fight between two tribes, the victors, in the accepted African custom, selling them to Arab slave dealers, who despatched them to the coast, where they were shipped by the "Mansuri" for sale to another slave dealer, who purposed setting them at work picking cloves on Pemba. The "Reindeer" will get £850 prize money for this capture.

Mombas, especially when approached from the sea, is the most picturesque of the coast towns, built high on a rocky irregular site overlooking the sparkling waters which are here so saline and clear. A fine old Moorish Fort standing on a coral hill 40 feet high dominates the anchorage. Dense masses of palms, tropical trees, flowering creepers and shrubs, tall grasses, and large quantities of vividly bright coloured flowers intersperse the varied features of architecture, while the many hued raiment of the mixed population gives a delightful oriental aspect to the whole scene.

Those whose business takes them to the East cannot help noticing the recurrence of scenes set out in Bible story, and in this connection my attention was drawn to the wells, especially at Mombas and Lamu, where they are sunk anywhere amongst the houses. They are stone lined, surrounded with a low stone parapet, where the native women meet with their water jars, and talk while waiting for their turn. The Sacred Historian writes:—

> "And Moses sat down by a well, and the daughters of Midian came and drew water for their fathers' flock—and the shepherds

came and drove them away, but Moses stood up and helped them and watered their flock."

So here at Mombas, at the largest well, I was standing watching the women drawing water, when, just as in the Bible narrative, the men came, drove away the women, and began to draw water for their own asses and camels. I was able to interfere, to give priority to those who came first, and to make the story complete, I took the bailing gourd slung by a cord spun from the ever useful fibre of the cocoanut baobob tree, and baled water for the women from the well, a practical repetition of Old Testament history.

Many of the old Portuguese residences, especially at Mombas and Lamu, are clumsy and rough without, but quaint and decidedly foreign within. Usually only two doors, a small back exit, a massive often carved front gate almost black with age, studded with huge iron spikes. Window spaces with no glass, but iron barred, wooden shuttered, curtained, are set in thick walls. Few internal doors, mostly Moorish arches hung with rich heavy curtains. The British Consul General's official residence, on the Horn at Zanzibar, is externally plain and uninteresting, but inside a veritable treasure house of costly rugs and big game skins, hangings and draperies of native weaving and colouring, polished wood of handsome grain, rich arms and decorations, strange curios and trophies, valuable uncommon furniture bearing the handiwork of many craftsmen, both native and foreign to Africa, who have left their mark on domestic art, the whole gorgeous in its barbaric furnishings.

Rider Haggard's novel "Allan Quatermain," is well known. At Lamu I stayed in the house from which Allan Quatermain set forth on his quest for King Solomon's Mines.

In some of the residences are beautifully kept collections of all manner of cunningly wrought native and Arab weapons in faultless condition, while the variety of heads and the exquisite forms of highly polished horns of African game is a revelation. I was offered a fine head of a double-horned rhinoceros for 5 rupees, besides my pick of an extensive collection of perfectly prepared heads and horns just brought down from the interior by a native shikari. For £5 I could have obtained a van load of exceptional interest, a comprehensive collection of specimens, showing not only the exquisite marking and colouring of the curiously twisted and branching horns, but an astonishing variety of shapes and forms of heads. In no museum have I seen such a varied display of the hunters' harvest.

Lamu, the smallest of the three ports, and perhaps the least interesting in most things, although numbers of dhows are built here,

is in my eyes of considerable attraction, for near by lies the famous "Battle Field of Am." In the 15th century the town and port of Am, and the settlement on the adjoining island of Manda, were defended to seaward by forts erected by the Portuguese to guard from native tribes and Arab raiders the factories they here established for trading—chiefly in gold, ivory and slaves. The Arab will abandon to decay, or actively destroy almost everything save books, which he spares for fear the name of God might be written therein, so here, the batteries are now more or less in ruins, although still armed with their quota of cannon and pyramidical piles of cannon balls standing rusty and weathered amid enveloping rank vegetable growth. The ordnance is apparently old ships' guns salved from wrecks of the many vessels of the earlier navigators cast away on this barbarous coast, for on the foreshore lies a mass of wreckage, broken capstans, lengths of heavy planking, splintered spars, sections of solid deck houses and so on.

The most picturesque fort is that of Manda, a restful shady spot at which to halt and shelter, for in the midst stand several wide spreading trees, from their branches depending a number of quaint birds' nests, the name of the builder being unknown to me. They are beautifully woven with fibre from the cocoanut tree in a curious fashion unfamiliar to British eyes. From a suitable twig the bird builds downward forming a cylindrical nest some 9 or 10 inches in length, the bottom of the nest being rounded and completely closed, and in it the soft nesting bed is made. About one-fourth of the way down from the twig, another, shorter cylinder only 3 or 4 inches long projects at an angle of some 30 degrees from the side of the main cylinder, the mouth of this shorter cylinder being left completely open. The bird enters at the open mouth, goes up the short arm to the top of the main structure, then descends the latter to the soft cushion lying at the base. I swarmed up the tree, found the nests were all empty, so cut down half a dozen as curiosities, which would interest my naturalist friends at home. After years of packing and unpacking, handling by curious enquirers, and much travelling, 18 years later they still hung in my room in an excellent state of preservation, showing how tough, strong and beautifully woven they were.

In the early days this port, the Island, and tribe dwelling hereabouts were alike known as "Am," subsequently extended to Amu, and finally brought to full fruition in its present form of Lamu, although the old hands still call it Am. The tribe of Am has had three distinct capital settlements, in all of which the Portuguese took some part in the making. The first lay close to the entrance of the

harbour where stands the present mean collection of Arab houses and native huts known as Shellu, but being too handy to the ocean was subject to raids by marauding neighbours, so the Am evacuated it and built a new town further up the inlet. Even there they were attacked but made good their defence. For some time after this victory the Am enjoyed peace and prosperity, and tradition says grew in luxury and pride to such a degree that they neglected the due worship of their God, who being thereby moved to anger against them, one night descended on the recalcitrant town in all the fury of a terrific African sandstorm, and in the few hours of darkness hurled down from the surrounding hills thousands upon thousands of tons of sand entirely obliterating and covering from sight the entire town, and with it a large number of the unfortunate inhabitants, who preferred to take their chance in the shelter of their kraals, rather than face outside the blinding sight destroying tempest which howled across the Island. The frail huts collapsed beneath the accumulating weight above, the wretched inhabitants perishing amidst their household belonging.

This may seem difficult of belief to those who have not seen the immense areas of loose, easily-shifted sand which are so common on many parts of this coast, but on the side of Old Lamu and all the neighbouring shores for leagues to the north and south, a noticeable characteristic is the prevalence of vast stretches of sand.

The burying of Old Lamu was very thorough, for a search along the sides of the enormous drift rising from the beach showed that the stronger built Portuguese dwellings and go-downs alone had partially withstood the strain, as at various points on the slope of the drift protruded sections of shattered stone or concrete walls and gables, but scan as I might, no sign whatever could be seen, not a single vestige of any native erection breaking the long, swelling stretch of sand where once the old town stood. This crushing calamity had been preceded by several instances of the partial burying of the town by sandstorms, so now the inhabitants who escaped, deciding to entirely abandon a locality so often menaced by peril, removed in a body to the present position of the new town, and so far their decision has been fully justified, as apart from the minor annoyances inseparable from the characteristics of their ever present sandy surroundings, no such extensive troubles as formerly threatened them have been experienced in their new home.

The most interesting feature of the district is the Battle Field of Am, a field of glory unknown to the historian and to the world at large, probably known to but few Europeans, for it is not easy of

access, there are no local means of transit, so the journey has to be made on foot across miles of shifting, burning sand, the fierce sun seeming to blister the top of one's skull despite the sheltering topee. To halt and rest is impossible, there are no trees, no shelter, and to sit on the sand is to be speedily burned through one's clothing. But when reached, the scene repays all trouble of the exhausting walk.

As far back as tradition records a bitter rivalry and warfare chronically existed betwixt the tribes of Am and Mombas. The former's island home lay some hundred miles to the south of the Equator, the latter were located on the seaboard another hundred miles or so further south. Periodically, the Mombas paddled north in their war canoes and made frontal attacks on the Am, usually with disastrous results to the latter, who when defeated fell back into the interior of their island, or crossed to the mainland, and so escaped utter extermination. Somewhere about 1833 a fierce encounter took place, but the Mombas were driven back with loss. Some 20 years later they organised another raid on a big scale, intended to be especially effective by making a landing at the back of the island, leaving their canoes there, crossing the island, and falling upon the Am from an unexpected quarter, so as to take them at a disadvantage. In accordance with their plan of campaign the entire fighting strength of what was then the very considerable Mombas tribe embarked in their fleet of war canoes, and after a fine passage landed on the Am coast. The attack was delivered as arranged—from the rear—the panic stricken Am being driven headlong into and partially through their town out on the other side ; finding that this time it was a matter of life and death, no escape, they quickly rallied, and fighting as they had never fought before, all hands, men, women, and children alike, joined in the defence. A sanguinary conflict raged in the town, but presently the Am drove their assailants back—a pitched battle followed outside, the Am again won, and steadily pushed the Mombas up the sandhills until the crest was reached overlooking the sea and the canoes, the scene of a former slaughter Here the Mombas made the final stand of the day—the fighting was protracted, close, and determined ; the Mombas fought with the knowledge that defeat meant annihilation, the Am with the hope that victory would rid them for all time of their powerful and dangerous neighbours. All along the ridge the struggle was maintained until at the close of the day the Am got their opponents on the run, drove them headlong down the slope into the sea, killing right and left as they went, and then in their conquering might dashed into the sea and destroyed the canoes also, a small remnant only of

wounded Mombas escaping in one or two shattered canoes, their Power broken, fighting men and war fleet alike practically destroyed.

Some four thousand fell in the fight, whose skeletons still lie thick around—tall and short, old and young, fine stalwart men of big bones and thick skulls, smaller framed and more lightly limbed youths, slight built boys, women and girls, all heaped in picturesque confusion, here a warrior with his head cleft from brain pan to jaw, there a skull separate from its trunk, near by a warrior with his arm lopped off, some with hands severed, or the forearm cut through—others with crushed ribs, broken limbs, or the face bones smashed in, while in several instances there was the grizzly sight of two antagonists who had closed in the fierce struggle lying just as they fell, their fleshless limbs still locked in the bitter death clasp, bony fingers clutching what had been an opponent's throat, a claw-like hand gripping an upraised arm poised to strike. Skeletons with set teeth and limbs intertwined still angrily grinning at one another sightless eyesockets continuing to grimly strive and wrestle for the mastery, showing, after all these years, how deadly was the conflict, how ferocious the hatred evolved by the lust of blood.

Numbers lay in perfect condition, stretched out on their backs, the skeletons entire and untouched, but on attempting to move them the bones fell apart, sinews and muscles perished by the tropical heat. Step where one might there were bones, as thick as autumn leaves in an English park, and like the leaves, crushing with a crackling sound beneath the feet.

The scene was a strange one, the unbroken solitude, the cloudless blue sky, the pitiless sun, nothing in sight, no shipping on the sea, no bird in the air, no murmur of insect, no rustle of wind, no living creature, save myself, on the land ; perfect peace and stillness, with all around the grinning dead, a veritable golgotha of perishing bones, the skulls with their empty eye-sockets and gleaming teeth seeming to silently watch and gibber at the stranger who trod and crushed their crumbling limbs. All were bleached to a dazzling white, lying on their sandy bed, thousands upon thousands of them, nothing green anywhere, no trees, no grass, just bones and sand together glittering with their blinding glare beneath the scorching sun.

Usually the burial party and Nature's green carpet quickly hide the human signs of strife, here, apart from the steadily encroaching sand which in time will give them sepulchre, neither man nor Nature has interfered, but as they fell, so the dead lie, mutely yet forcibly telling the tale of the well-fought fight of nigh 40 years ago.

ANNIVERSARY ADDRESS.*

BY A. A. SPOWERS, *Fellow*, PRESIDENT.

It is the usual custom that the retiring President should deliver an address to the members of the Society at their annual general meeting; and, although the subject of such an address is always left to the author himself, it is generally understood that it should have some reference to the work of the session or to the progress of exploration and discovery during the year. For a considerable time the former has been summarised in the report of the Council, which also makes some allusion to the various changes that may have taken place during that term.

From a geographical view-point, the last two or three decades have witnessed some of the greatest achievements in the field of exploration and discovery, yet known to man. In the Polar regions alone these have been unequalled in the history of the world, for the South no less than the North has been forced to reveal many of the great secrets that for ages were hidden beneath the vast snow fields and enormous ice-barriers of the Antarctic continent. But before going further in this direction, some reference must be made to those countries which, by virtue of their position and importance have the right to be considered in their proper geographical sequence. In Europe, there is now little left for the explorer to do, and very few features of geographical importance remain entirely unknown. Still, the work of co-ordinating our acquired knowledge of the physical structure of the more remote parts of Europe requires increased attention, while the geodetic values of some of the principal continental features are wanted before a true delineation of the topography of the continent can be accomplished. In Africa, there is a still greater need for extended operations in the trigonometrical determination of the principal features of that great and interesting country, where large areas of untrodden forest and tracts of open plain and

* Delivered before the Royal Geographical Society of Australasia, Queensland, Nov. 29th, 1912.

river valley have yet to be explored and opened up to industrial enterprise. In the equatorial provinces, as well as in Morocco, the Sudan region, and the Rhodesian country, the work of exploration has been carried on at intervals during the period under review, with energy and enthusiasm.

Under the direction of Sir David Gill, formerly Astronomer Royal at the Cape, the triangulation of South Africa has been firmly established and completed over extensive tracts of territory, and the secondary triangulation is now being steadily advanced. Although the events of recent times have greatly altered the political map of this country, which is now dominated by one vast federation or union of States, there is still associated with the history of the peoples many interesting features of their environment and industrial life, indicating a more or less adherence to original geographical conditions. It is true the boundaries of former independent or free States are no longer recognised by the Government of the country, but the Dutch settlers still cling to old traditions and love their Mother tongue. However, it is only a matter of time when the English language will be in common use, and the old order of things will pass away altogether. There will then be more general enlightenment amongst all classes, and peace and harmony will take the place of strife and bitterness of feeling. In an interesting and instructive paper by the Hon. F. T. Brentnall, read at one of our monthly meetings during the preceding session, and in former contributions to our literature, the attention of our members was drawn to the great development of South Africa during the life time of the late Cecil Rhodes, and we were especially reminded of the remarkable progress made in the colonisation of Rhodesia by the British during recent years. That this progress is real and substantial is clearly enough shown by the rapid settlement of the country.

In the Congo Free State, too, our good neighbours, the Belgian colonists, have for many years been actively engaged in the opening up of the densely timbered areas of the Congo River basin—a remarkable fertile territory, which recently has loomed so largely in the public eye on account of the unpleasant rumours associated with the administration of the country, and the alleged barbarous treatment of the native inhabitants. But geographically, the work of the Belgian explorers is of great interest, comprising as it does many valuable additions to our knowledge of the Flora and Fauna of the region, and these have been rendered accessible through the medium of numerous publications distributed liberally throughout the world.

But for geographical work of high order and importance it is to India we must turn our attention and examine the results of the Great Trigonometrical survey extending from the highest peaks of the mighty Himalayan chain to the sea-shore and the borders of Afghanistan and Tibet. For many years the officers of the Survey Department of India have been extending the major triangulation over that vast territory to the remote parts of the country, and this great and important work has been carried out in the face of many dangers and hardships to the manifest advantage of science and commerce, while the minor, though scarcely less valuable cadastral survey has been correspondingly developed over the settled area, and throughout the provinces. It is indeed difficult to over-estimate the economic and scientific value of these great undertakings and their far-reaching influence on the industrial life of the Empire. Associated with the astronomical or geodetic determination of positions and the correct delineation of physical features, is the no less important geological survey, which, being carried out by a highly trained staff under the direction of an efficient leader has yielded results which rank with the first of their kind in any part of the world.

On previous occasions of this kind some brief allusions have been made to the excellent work accomplished in Central Asia by Dr. Hedin and Sir Muriel Stein, the former for his great exploratory achievements in remote or isolated desert regions, and the latter for the extent of his archeological discoveries, including material of priceless value, now deposited in the British Museum. There is, however, nothing new to record in the work of these famous explorers, as some considerable time must elapse before the results of their discoveries can be examined and published.

But I may briefly refer to the excellent work carried out by Dr. and Mrs. Workman, who at the end of last year returned to India from their seventh Himalayan expedition, their investigations having this time been mainly carried out in the Eastern Karakoram. They explored the mountain and glacier region south of the Baltoro glacier, between the latter and the Shyok and Saltoro valleys from the Kondus Siachen watershed on the east to the western barriers of the glacier's tributary of the Hushe River on the west, including the Dong Dong, Serpi-gang, Kondus, Chogo Lisa, Kondokoro, Masherbrum and Alin glaciers.

No traces of any of the passes reputed to exist between this region and the Baltoro could be found, all glacier-reservoirs being enclosed by high, very abrupt and unscalable rocky walls, and many of the upper portions of the glaciers being so steep and broken into

seracs as to be inaccessible. On concluding the exploration of the region directly south of the Baltoro, the Bilapho glacier was ascended, the ice-covered pass at its head, about 18,550 feet above sea-level crossed, and the descent to the Siachen glacier made, where the explorers remained four weeks. This glacier, the largest of its kind yet discovered in Asia, is probably 50 miles if not more in length, and is fed by seven large branches. The highest mountains lie along the western side of the glacier, a number rising in separate peaks of great size, the most impressive of these being K3, with its two summits of 25,210 and 25,415 feet. Owing to the lateness of the season the cold was found to be very trying, epecially when the wind was strong. At 16,000 feet a temperature of 5 degrees Fahr. was recorded on three occasions. Considerable new material, geographical, physiographical, and glaciological, was gathered, and as the weather was fine most of the time a large collection of photographs, panoramas, and telephotographs was secured.

The new world furnishes little to note of wide interest in the field of exploration and discovery, with the exception of the expedition sent out to Alaska by the National Geographic Society, under the direction of Professors Tarr and Lawrence, the former of whom was unfortunate enough to lose one of his notebooks containing data on a month's work, while studying the glaciers of the region. This, the third of the research expeditions sent out by the National Geographic Society, made some important observations on the conditions of the present glaciers and past glaciation of the Kenai Peninsula, near Seward, and the Alaska Northern Railway, the work being extended along the Coppermine River, over the white Pass, and in south-eastern Alaska, near Lynn Canal, Glacier Bay, Taku Inlet, and the Stikine River. The explorers travelled 1,200 miles up the Yukon River by steamer, and made the first summer journey ever attempted from the coast at Cordova by rail to Chitina, and thence 320 miles across Central Alaska in a buckboard to Fairbanks, the time occupied on the work being four months. Contemporaneous with this American enterprise, we find Dr. Anderson and Mr. Stefansson completing their investigations in the extreme North of Canada, where they have been engaged for over three years exploring the hitherto unknown region between the Coppermine River, Great Bear Lake, and the shores of the Arctic Ocean, their researches having brought to light a great deal of new geographical and ethnographical information. House ruins were found here and there from Cape Lyon to Inman River, while Eskimo camps were discovered all over the area between Great Bear Lake and the

Coppermine ; contrary to the accounts of former travellers. On the coast, too, settlements were found west of Cape Krusensten, none of whose inhabitants had ever seen a white man. On the south coast of Victoria Island, north of Cape Bexley, a discovery was made which has attracted a good deal of public attention—that of a light-coloured people who from their appearance would have been pronounced three-quarters Europeans rather than Eskimos. They present a remarkable problem, and Mr. Stefansson hints at the possibility that they may be descendants either of some of the lost members of Franklin's expedition, or of the Icelandic Scandinavians, who disappeared from Greenland in the fifteenth century. A geographical discovery is that of the course of the Horton River, between Great Bear Lake and the Arctic coast, the mouth of which was determined by Franklin on his second overland expedition. Dr. Anderson, whose journeys were made in part independently, has secured many natural history specimens. Both explorers suffered a good deal of hardship, as their method was to live on such supplies as the country afforded, and food was often difficult to procure, owing to the great diminution in the number of caribou. In no part of America is there perhaps greater public interest manifested at the present time than in the Panama Canal Zone, where stupendous works of excavation are nearing completion, and will lead to the opening up of a great International Highway between the Pacific and the Atlantic Oceans. This gigantic enterprise originally taken up by the French, and intimately associated with the name of De Lessips, is undoubtedly destined to exercise a world-wide influence on commerce and transport, as well as on the industrial life of all civilised nations. Already the United States Government has enacted laws for the regulation of traffic through the canal and the conservation of American rights and interests. Exploratory enterprise in Australasia during the preceding twelve months has been almost exclusively confined to New Guinea, and both the Dutch, German and British possessions have contributed in no inconsiderable measure to our knowledge of the geography of that interesting country. With the idea of following up the work carried out by the expedition of the British Ornithologists' Union to Western New Guinea, Mr. A. F. R. Wollaston, who took part in the British Museum expedition to Ruwenzori in 1906, has obtained the permission of the Dutch Government to explore the Snowy Range, which was approached, but not reached, by the British as well as by the Dutch in 1910. An attempt will be made to reach the watershed, and if possible to climb Mount Carstenz, the highest point in the range (15,964 feet.) As the leader left the old

country in May, in order to recruit Dyaks in Borneo, and to land in New Guinea in September, so as to take advantage of the comparatively dry months of November and December, it is presumed that the party will now be actively at work on the arduous task before them, and that in due course the results of the expedition will be made known to the world at large.

In an interesting paper published in the April number of the "Geographical Journal," and previously read at the February meeting of the parent Society, London, the Hon. Miles Staniforth Smith, Administrator of the Territory of Papua, gives a full account of his expedition to the Western Division of the possession, about the end of last year, when a large area of new country was traversed and much valuable information obtained concerning the natives, the physical features and geological conditions observed. In the geographical world, the most interesting events of the year have been the Antarctic expeditions of Scott and Amundsen, and the circumstances associated with the attaining of the South Pole by the latter. In the early part of the year Captain Amundsen paid a visit to Brisbane, and delivered an address at the Centennial Hall, under the auspices of our Society, on the splendid work accomplished by his expedition to the South Polar regions, conducted under comparatively easy conditions, and although we as yet know little of the scientific results of that daring enterprise, it may be assumed that they are of considerable value, and when made available will no doubt throw a flood of light on the geographical conditions of the Antarctic continent. When last heard from, Captain Scott was continuing his work with undiminished vigour, and it is anticipated by the Home authorities that he has reached the Pole long ago. His return to England in probably less than a year hence will be looked forward to with deep and wide interest, and he will, no doubt, bring back a rich harvest of scientific results. News has also been received from Dr. Mawson, who, as we all know, is conducting an expedition equipped by this country for the examination of the coast line westward from Cape Adair. He had successfully landed on Adelie Land, and there is every reason to suppose that his programme will be carried out with success.

In this cursory review of the geographical work accomplished during the year, some slight reference must be made to such movements as may fairly be considered to come within the field of view. In the order of importance, first allusion may be made to the conference of Surveyors-General, held in London in the month of May, 1911, at which I had the honour of attending as one of the delegates

representing the States of Australia and the Dominion of New Zealand. Delegates were also present from the Ordnance Survey of Great Britain, the Institution of Surveyors, and the Institution of Civil Engineers, London, and the Dominion of Canada; South Africa, while fully recognising the importance of the conference regretted that the re-organising of their service prevented them from sending a representative. The conference had for its main object the establishment of reciprocal relations within the British Empire to enable Surveyors duly qualified in any one of the several parts thereof to practise their profession in any other part without further qualification test, except as to local requirements. As a result of the deliberations of the conference it was agreed that a central board should be established to maintain the standard of examinations throughout the reciprocating parts of the Empire, and this will no doubt be an essential feature of the scheme, which should prove to be of great advantage to the profession as well as to the public.

Another conference, which although more of local importance than the preceding should be productive of useful results. I allude to the conference of Surveyors-General of the States and the Dominion of New Zealand, with the Commonwealth Director of Surveys.

The object of the conference was to consider several matters of importance to the Commonwealth and States respectively, chief among them being the trigonometrical survey of Australia.

Unfortunately, up to the present time but little has been done in this direction in Australia. It is true that each State has contributed something, but the work accomplished is fragmentary and varies considerably in both accuracy and utility. Perhaps the only State having an up-to-date survey is N.S.W., but even there little progress has been made during the last eight or ten years, and it is a matter for regret that the responsible authorities have failed to grasp the vital importance of such a survey or that funds have not been made available for this very necessary work. An accurate trigonometrical survey commencing in the coastal districts, and extending gradually to those parts of the interior only sparsely occupied would be of immense advantage in the industrial development of the country. It would afford a number of accurately determined points to which all other surveys could be referred, and would form the basis of necessary topographical surveys, required, not only for the purposes of settlement, but also for the preparation of an efficient scheme of defence. It would likewise aid the surveyor and engineer in settlement surveys and in road and railway location, and only those who are immediately connected with the preparation and construction of our

maps and charts can estimate its great value in efficiently carrying out that work.

Another important subject dealt with at this conference was Australia's contribution towards an International Map of the World on a scale of 1 : 1,000,000. The proposal for the production of this map was first brought forward at the International Geographical Congress, held in Berne, in 1901, and was discussed at succeeding Geographical Congresses, but it did not assume definite form until the meeting which assembled at Geneva in 1908, where certain resolutions were unanimously adopted. These were forwarded by the Swiss Government to the British Government, and the latter realising that the resolutions would remain inoperative unless officially adopted, invited the Governments of practically all civilised nations to send delegates to England to discuss the matter and draw up definite recommendations.

The delegates met in London in 1909 and recommended a scheme, which has since been adopted, and in many countries the maps are now well under-weigh. Nothing, however, has been done in Australia, although she was represented at the conference in London. Everybody's business is nobody's business, and if the Commonwealth Government do not step into the breach it is doubtful if the States will undertake the work.

That it is a work for the Commonwealth seems certain, for if carried out independently by the States there would be questions of overlapping to consider and adjust, and the unequal distribution of the work would press heavily on the larger States—for instance, Queensland would be required to produce nine complete and four parts of sheets, while Victoria would be covered by three partially completed sheets.

I have great pleasure in recording the fact that the conference met with a very sympathetic hearing by the Federal Authorities, more especially in regard to the trigonometrical survey, and I have every reason for believing that this important work will be taken in hand at an early date.

THE LEAF BOOMERANG OF THE BELYANDO TRIBE.

BY F. B. CAMPBELL FORD, Staff Surveyor.

In 1883, while acting as assistant to the late H. B. Rogers-Harrison on an extensive feature survey of the Belyando River, and all its tributaries, the course of which till then had never been defined, I had with prismatic compass and perambulator traversed Trump Creek from the Avon Downs lagoon—a fine sheet of water 10 miles long—to the Suttor River, and down that river to the confluence of the Belyando. After finding and connecting to an old marked tree defining the termination of a similar exploratory survey by the late A. J. Richardson, I packed up to return to Avon Downs—at that time an out-station of Kilcummin—where I had to rejoin my chief

As there was no track of any sort to follow, and our route was through a wide tract of flooded country with dense Gidya scrubs (Acacia homalophylla) Polygonum swamps, and a network of shallow channels, of which it was hard to say that any one was the principal, I left the tongues of the bells unmuffled on the packhorses to checkmate a tendency of both men and beasts to play " hide and seek " whenever the occasion presented itself and took the lead, the cook and another man (" Arcades ambo," or bad bushmen both), driving the horses in my wake, but on the second day the cook dropped behind, and despite the bells managed to get lost. On his failing to overtake us in about half an hour I halted the horses and went back to look for him, and after spending some time in cooeeing and knocking on a dry, hollow log with the back of a tomahawk—a noise easier to locate and carrying farther than bells or cooee,—journeyed on to Avon Downs, hoping, though hardly expecting that he had passed us during the delay; but finding on arrival that he was still missing, procured some fresh " tucker " and two blackboys (one an ex-trooper with rather a bad reputation and the other a " myall " or uncivilised black) and started

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* Written for the Royal Geographical Society of Australasia, Queensland.

back to search for him, leaving the other man at the station, as he would have been more of a hindrance than a help on such a quest.

Having at that time little experience of the natives, though I had heard a good deal about their treachery, and one or two evil tales in particular of Joe, the ex-trooper, I do not mind confessing that I had an attack of nerves the first night, and dreaded the idea of going to sleep. We had camped at Lake Suttor, a fine, wide water-hole, right in the heart of a large belt of dense scrub, and after supper Joe was relating with great gusto to his mate the history of a " dispersal," in which he had taken part as a trooper, and in which the mob wanted was surrounded in this self-same lake, and some of the more gruesome details at which they laughed immoderately, were repeated in English for my edification, and, of course, hardly acted as a sedative.

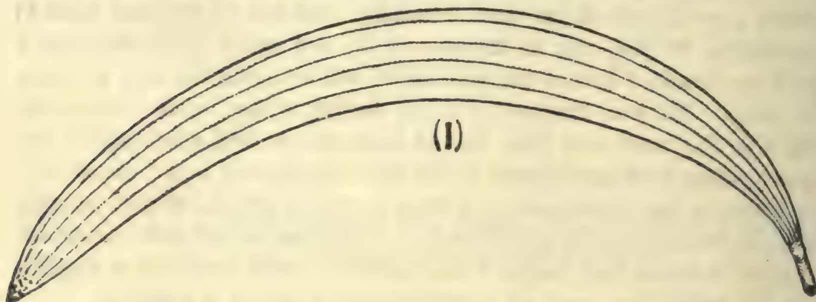
Later, piling a lot of bushes on the fire to make a big flare, they started playing " Bindjhera," a game in which the dead leaves of the brigalow (Acacia harpophylla) were made into miniature boomerangs, and flipped with a rotary motion into the current of hot air, where, spinning with increased velocity, they climbed up and up in a beautiful spiral until they lost the influence of the draught and fluttered dejectedly down to mother earth again.

I kept them playing this game until they were too tired to play any more, but their kindness and patience in showing me again and again, till I acquired the knack, and the fun and laughter, had promoted such a feeling of good fellowship that I rolled myself up in a blanket a little to the windward of them, and slept as unconcernedly as they did. The evening, however, made an indelible impression on my memory, and every detail is as clear cut now as if it had happened but yesterday—the glare streaming far out on the water and revealing the wild beauty of the banks, touching up with a gleam of gold the mis-shapen and knotted boles and the silvery grey leaves, and intensifying the eeriness and gloom of the dense bush beyond, and round the fire the two excited black faces upturned to watch a successful flight, with the soft but emphatic " Yuck-kai " of the myall, and the equally emphatic, but utterly incongruous " Holy Ghost " from Joe.

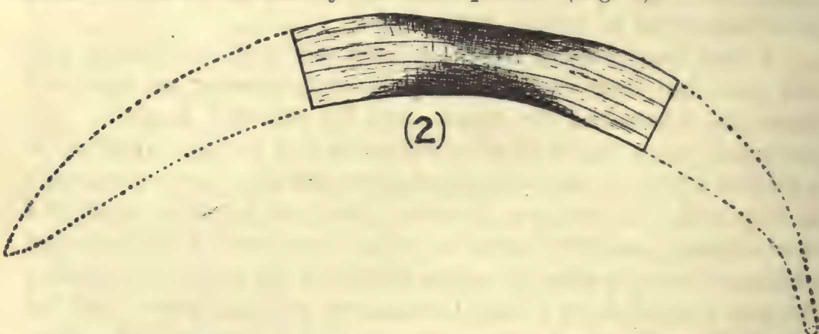
Only a few old bushmen that I have met have seen or played this game, and fewer, alas, are now ever likely to, so the manner of preparing the leaf and imparting the spin to it are perhaps worthy of record, in as much as this pretty pastime, suggested perchance by a falling leaf, might easily be conjectured to have had some bearing on the origin of the boomerang.

Choosing a thoroughly dry and flat leaf (" Bee'an " leaf, " Boonooroo " brigalow) with moderate curve (Fig. 1), or rather what on a brigalow tree does duty for a leaf, it was held close to the

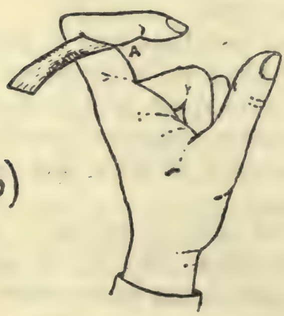
flame (" Booree ") for a second or two, breathed upon until the moist breath made the hot leaf temporarily somewhat flaccid, and then pinched laterally until concave for about one inch in the middle;


(1)

holding the middle pinched between the finger and thumb, about a third of the leaf at each end was doubled back towards the convex side and broken off square, the extremities of the boomerang being flattened, and the concavity rendered permanent by the same operation as the leaf quickly regained its rigidity, care being taken that the flattened ends set in exactly the same plane. (Fig. 2).


(2)

With the concave side down, a corner of the prepared leaf was held in the crease of the middle joint of the hooked index finger of the left hand (Fig. 3), and the point of the middle finger of the right

(3)



(4)

hand placed almost behind the joint and touching the corner of the leaf (Fig. 4), pressure was then exerted until the finger slipped off the joint with a flip, projecting the missile with considerable force, and communicating to it the desired spin. The fingers of the left hand pointed up if it was desired to send the leaf to the left or down if a right handed direction were wanted.

The flight of this miniature boomerang in a current of hot air is really most fascinating to watch, and I plead guilty to playing with one on occasion still ; with a strong up draught a good leaf will ascend to a great height, and generally makes many exciting journeys before by mischance it drops into the fire or is lost, while the rivalry becomes very keen when two or more are spinning furiously at the same time and mounting higher and yet higher as if for the time being endowed with life and ambition. Cessation of spinning is caused by the leaf getting outside the influence of the draught, so the alighting place is generally some distance from the fire ; to find a fallen one in the flickering light on a carpet of similar leaves seemed an easy matter to the keen-eyed blacks, but not so to myself.

On first thoughts, it would appear rather remarkable that this interesting game was not described by some of the earlier writers, as one would expect it to be very popular and widely spread over the continent, but consideration discloses two cogent reasons, in my opinion, for the omission.

First, that it would be almost confined to the brigalow country, as no other leaf that I am aware of would make a quite satisfactory "Bindjhera," owing to lack of rigidity, curve, flatness or size, all of which qualities are to be found at any season of the year in the litter of a brigalow scrub The brigalow, however, does not develop a proper leaf, but a flattened, woody leaf stalk only, which is quite stiff and brittle when dry, and takes a very long time to decay. Many other acacias have a similar habit, but the leaves of some, the Gidya, Boree or Myall for instance, though they can be used, are too small and narrow, while those of others, such as some of the very widely distributed "Wattles," though large enough and nicely curved, decay very quickly, are too limp and seldom flat, and this flatness of the under side of a boomerang is such an essential to satisfactory flight, that I have seen an aboriginal when finishing off a newly made weapon ("Wongal"), with illimitable patience spend hours to attain it with the aid of grease, heat and carefully applied pressure.

Second, that the natives' chief care when they owned the continent was to guard against being surprised by enemies, and evidence of this is to be seen in the strategic position of their ancient camps,

so much so that on almost any well-watered creek, where a high bank at a bend commands an uninterrupted view all round, one is seldom disappointed in finding some evidence of their former life, whether it be a discarded tomahawk or knife, a heap of mussel shells, or only a bit of rock geologically out of place, such as a block of granite that has been used as an anvil, a round or oval quartzite boulder for striking, a piece of sandstone shaped to fit the hand for grinding, or may be only a chip or two of diorite or flint ; careful search generally rewards one with something. It follows, therefore, that they had a great aversion to advertising their whereabouts by large fires,—a fact from which the quite common bush expression, " a blackfellow's fire " originated,—and only on their periodic incursions into the main scrubs, in search of material for new weapons, where the brigalow attained its largest and straightest growth, and where its hard black wood could be obtained free-splitting and clear of knots, would they feel quite safe from surprise, and justified in being so lavish in the matter of illumination as this game entailed.

I am indebted to Mr. James Muirhead, formerly of Elgin Downs, but now of Craven, who talks the Belyando dialect, but who had, unfortunately, forgotten the native name for the game, and to Mr. H. Bacon, the Staff Surveyor for the district, for the very considerable trouble they incurred in trying to rescue the almost lost words from oblivion. They both report that the younger men could not tell them, but that later each came across an aged man or two who remembered. As a result of their enquiries, I find that the Yangaburra tribe (Jericho to Blackall) call it " Birr-e-du," the Wakelburra (Belyando) and Babbingburra (Nebo) tribes call it " Bindjhera " and " Birran ; " these last were doubtless originally different dialects of which the limits are now broken down.

Dr. Roth, in his exhaustive work,* under the heading of games, makes brief mention of a Cloncurry tribe playing smoke spirals with a leaf or other small article, and illustrates by diagram a similar method of propelling the missile into the smoke, but the leaf depicted is an ordinary nearly round one, and is held flat against the forefinger, and, apparently, the artificially imparted concavity which causes the draught to lift and spin the leaf is absent. Dr. Roth also, in common with other writers, mentions the universally used bark boomerang for playing about, thrown in the ordinary way by hand, and called " Minthering " on the Belyando. As far as I am aware, however, nobody has described in detail the graceful and interesting play with the leaf, so I trust that this little reminiscence may prevent

* Ethnological Studies among the N. W. Central Queensland Aborigines. By W. E. Roth.

its being lost as so much that was worth learning from the departing race, especially in the matter of Bushcraft, must inevitably be.

There remains but to find the cook, which, thanks to some wonderful tracking by the boys, we did on the fifth day of his wandering; though somewhat scared he was little the worse for his experience, but his poor horse was in such a sorry plight that it could hardly raise a whinny at sight of its mates; it had been ridden all day and tied up all night, and Joe went up yet another peg in my estimation for his unconcealed indignation at its condition.

12/1/13.

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

REPORT OF COUNCIL, 26th SESSION, 1910-11.

The Council has the honour of submitting to the Fellows and Members the Twenty-sixth Annual Report on the operations of the Society during the financial year ending on the 30th June, 1911. While pleased at the number of new members added to the roll during the period under review, the Council feels grieved at the loss sustained by the lamented death of six worthy supporters, including Lieutenant-Colonel James Irving, who as one of the oldest and most loyal adherents of the Society, was for many years a greatly valued officer and councillor. The others who passed away are the Hon. J. T. Bell, Messrs. Kendall, Broadbent, John Davies, Philip MacMahon and J. F. Thallon, who as greatly valued members of the Society, will be much missed at the monthly meetings and other periodical functions.

The financial statement, hereto appended, shows a credit balance of £115 19s., from which, however, is to be deducted the cost of printing the last volume, amounting to £75 18s. 2d. As a set off against current liability there are outstanding subscriptions to the amount of £30, which it is hoped will be paid during the ensuing session. Besides the current credit balance there must be taken into account the Thomson Foundation Medal Fund of £250, vested in Royal Bank Preference Shares, and the accumulated up-to-date interest thereon of £12 13s. 1d., deposited in the Government Savings Bank.

The Library of the Society may, with singular appropriateness, be alluded to as a constantly increasing quantity, as year by year it continues to grow; even now there is a great task on the available space at the disposal of the Council for adequately shelving the numerous valuable works received from exchange societies and other sources. The splendid works in the library available to members of the Society for reading and for reference, are both numerous and various. It is to be regretted that they are not put to better use.

The Council is pleased to be able to report that during the session satisfactory arrangements were made to have the Society represented at the Tenth International Geographical Congress, to be held this year at Rome, Messrs. A. A. Spowers and E. C. Barton having been appointed delegates to the Congress before leaving Brisbane for Europe.

Following the usual course adopted for several preceding years, the Council desires to recommend :—(1) The suspension of so much

of the rules as provides for the payment of an entrance fee ; (2) The re-appointment of Mr. A. S. Kennedy as Hon. Librarian, and of Mr. Robert Fraser as Hon. Auditor ; (3) The re-appointment of Messrs. Alexander Muir and Robert Fraser as unofficial members of the Council, and the appointment of Mr. W. H. Mobsby as Hon. Lanternist.

Taking advantage of Section IV. Clause 3 of the Constitution and Rules, the Council has conferred the Diploma of Fellowship upon Alexander Corrie, Esq.

The Council, in warmly thanking all those who have so ably and loyally contributed to the success of the past session, by the reading of valuable and interesting papers, desire to again express their obligations to Mr. A. S. Kennedy, the Hon. Librarian, and Mr. Robert Fraser, the Hon. Auditor, whose long and faithful services are greatly appreciated.

The thanks of the Council are also due to Mr. H. W. Mobsby for assistance rendered at the monthly meetings of the Society with the lantern.

STATEMENT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND,

From the 1st July, 1910, to 30th June, 1911.

Dr.

	£ s. d.	£ s. d.
By Funds at close of last Account—		
,, Bal. in Govt. Savings Bank ..	36 14 11	
,, ,, Royal ,, ..	23 5 10	
		60 0 9
,, Annual Subscriptions Received	152 4 9	
		152 4 9
,, Interest on Govt. Savings Bank Deposit	1 1 7	
		1 1 7
		£213 7 1

Cr.

	£ s. d.	£ s. d.
To Expenditure as per Accounts—		
,, Gas Accounts	1 10 3	
,, Fire Insurance Premiums ..	3 15 0	
,, Expenses of 25th Anniversary Meeting	8 15 10	
,, Expenses of General Meetings	11 16 3	
,, General Postage, Printing Notices of Meetings, etc. ..	25 2 1	
,, Advertising Meetings	1 16 6	
,, Incidentals	3 14 9	
,, General	10 3 7	
		66 14 3
,, Hon. Treasurer	30 0 0	
		30 0 0
,, Exchanges	0 2 10	
,, Bank Charges	0 11 0	
,, Bal. in Govt. Savings Bank ..	37 15 6	
,, ,, Royal ,, ..	78 3 6	
		*116 12 10
		£213 7 1

*Note.—The amount of liability for printing on account of year 1910-11 is £75 18s. 2d.—J.P.T.

Examined with Bank Pass Books, Vouchers, etc., and found correct.

ROBERT FRASER, Hon. Auditor,

7th July, 1911.

J. P. THOMSON, Hon. Secretary and Treasurer, 6/7/11.

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

REPORT OF COUNCIL, 27th SESSION, 1911-1912.

The Council has the honour to submit to the Fellows and Members the Twenty-Seventh Annual Report on the operations of the Society, for the financial year ending on the 30th June, 1912. While it is satisfactory to allude to a substantial increase of new members during the session, the Council would be pleased to welcome to the privileges of Memberships a far larger number of citizens than appear on the roll at the present time, and those who usually attend the meetings of the Society would render a service to the cause of geography by assisting to increase the number of supporters. The losses occasioned by death include the Right Honourable Lord Stanmore, one of the oldest Honorary Members, Mr. C. C. Cameron, a Life Member, and Mrs. A. A. MacDiarmid, who will long be remembered as a regular and interested attendant at our periodical meetings.

By the financial statement hereto appended, the credit balance is shown to be £76 5s. 7d., exclusive of the Thomson Foundation Medal Fund of £250, vested in Royal Bank Preference Shares, and the accumulated up-to-date interest thereon of £31 19s. 7d., deposited in the Government Savings Bank, and which brings the Fund up to £281 19s. 7d., or only £18 0s. 5d. less than the amount originally required for the capital sum.

The continuous growth of the Library has rendered it necessary to have the numerous valuable works therein properly catalogued and arranged in order on the shelves so as to be easily accessible to our members at all times. The work of cataloguing has been carried out at a cost involving an extra drain on our limited income, but it is hoped that by the generosity of members the amount will be made good. Already, about a third of the sum needed has been generously donated by our late Hon. Librarian, Mr. A. S. Kennedy, to whom the cordial thanks of the Society are due.

Following the course adopted for some time past, the Council desires to recommend :—(1) The suspension of so much of the Rules as provides for the payment of an entrance fee ; (2) The appointment of Mr. E. E. Edwards, B.A., as Honorary Librarian, and the re-appointment of Mr. Robert Fraser as Honorary Auditor, and of Mr. W. H. Mobsby as Honorary Lanternist ; (3) The re-appointment of Messrs. Robert Fraser and Alex. Muir as unofficial members of the Council.

The Council also desires to recommend that Mr. J. B. Henderson, M. Inst., C.E., M. Am. Soc., Eng., Hydraulic Engineer, be elected an Honorary Member of the Society, in recognition of the great value of his work in connection with the water supply of the State, and the services thereby rendered to Geographical Science

In cordially thanking those who have so greatly contributed to the work of the session by the reading of valuable and interesting papers, the Council desires to again acknowledge the obligations of the Society to Mr. A. S. Kennedy, who has been obliged to relinquish the position of Honorary Librarian after several years of faithful service, on account of the exacting nature of his official duties, to Mr. Robert Fraser, the Honorary Auditor, and to Mr. W. H. Mobsby, who has assisted greatly at the monthly meetings with his lantern.

STATEMENT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND,

Dr. FROM THE 1ST JULY, 1911, TO 30TH JUNE, 1912. **Cr.**

Dr.	£	s.	d.	£	s.	d
By Funds at close of last Account—						
,, Bal. in Govt. Savings Bank ..	37	15	6			
,, ,, Royal ,, ..	78	3	6			
				*115	19	0
,, Annual Subscriptions Received	151	16	9			
				151	16	9
,, Interest on Govt. Savings Bank Deposit	1	2	2			
				1	2	2
				£268	17	11

Cr.	£	s.	d.	£	s.	d.
To Expenditure as per Accounts—						
,, Gas Accounts	0	14	11			
,, Fire Insurance Premiums ..	3	10	0			
				4	4	11
,, Printing Journal, etc.	84	5	6			
				84	5	6
,, Expenses of General Meetings	19	2	6			
,, General Postage and Printing Notices of Meetings ..	21	11	4			
,, Advertising Meetings, etc. ..	2	10	0			
,, Telephone Charges	8	19	9			
,, Cleaning Rooms, etc.	12	11	0			
,, Repairing Furniture	4	12	7			
,, Incidentals	1	2	4			
,, General Expenses	2	3	0			
				72	12	6
,, Hon. Treasurer	30	0	0			
				30	0	0
,, Exchanges	0	18	5			
,, Bank Charges	0	11	0			
				1	9	5
,, Bal. in Royal Bank	37	7	11			
,, Bal. in Govt. Savings Bank ..	38	17	8			
				76	5	7
				£268	17	11

*Less £75 18s. 2d. for Printing on account of the year 1910-11.

Examined with Bank Pass Books, Vouchers, etc., and found correct.

ROBT. FRASER, Hon. Auditor,

10th July, 1912.

J. P. THOMSON, Hon. Secretary and Treasurer, 10/7/11.

Royal Geographical Society of Australasia,

QUEENSLAND.

FOUNDED 1885.

DIPLOMAS OF FELLOWSHIP.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 3, Constitution and Rules (*See page 2 of Cover*) :-

Honorary:

His Excellency Sir William MacGregor, G.C.M.G., C.B., M.D., LL.D., D.Sc., Hon. F.R.S.G.S., etc.

The Right Hon. Lord Lamington, G.C.M.G., G.C.I.E., B.A., F.R.G.S., Hon. F.R.S.G.S., etc.

The Right Hon. Sir S. W. Griffith, G.C.M.G., M.A., etc.

Under subsections (a and b) :—

Charles Battersby, Esq., J.P.
Robert Fraser, Esq., J.P.
E. M. Waraker, Esq., J.P
R. M. Collins, Esq., J.P.
Alexander Muir, Esq., J.P.
C. B. Lethem, Esq., C.E.
John Cameron, Esq., J.P.
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DR. DAVID LIVINGSTONE'S "FOOTPRINTS ON THE SANDS OF TIME."*

BY HON. F. T. BRENTNALL, M.L.C., President R.G.S.A.Q.

"Footprints on the Sands of Time" is a pretty poetical idea. Perhaps more fanciful than practical. Dr. David Livingstone was a practical man. With him "life was real and earnest." During his African explorations he may have trod on sands; but with firm step and certain aim he trod swamps and plains, forests and mountains. We all know that footprints on the beach, after the tide has receded, quickly fade under the stern, billowy outrush of the next tidal flux. There to-day, not there to-morrow. Only as a poetic simile can the poet's expression apply to Dr. Livingstone. His plodding feet trod the sandstone, aye the granite, of permanent utility and imperishable renown. He has left the impress of his records on the nineteenth century. His aims were not visionary, his objects not selfish, his resolves not transitory. His early longing, predilection and aspiration were for a sacred mission; first in China, later, by the influence of Dr. Moffatt's example and arguments, for Africa.

To many notable sons of the British Isles, even in recent times, Africa has been the alluring arena of noble service, the birthplace of illustrious celebrity. In the North, Wolseley, Gordon, Cromer, Kitchener. In the Central, Burton, Speke, Grant, Baker, Stanley. Dr. Livingstone belongs mainly to South-central Africa. He left memorable footprints right up the country from the Cape to Lake Nyanza, thence by way of Linyantie to Loanda, the capital of Angola, on the west coast. He was then an authorised agent of the London Missionary Society, in which capacity he went from station to station

* A short paper read before the "Royal Geographical Society of Australasia, Queensland," at Brisbane, on the 11th April, 1913, in commemoration of the centenary of the great explorer's birth, on 19th March, 1813, at Blantyre, on the River Clyde, Scotland.

teaching to the natives the rudimentary truths of Heaven's evangel of peace. As a pioneer of revealed religion, in search of new openings for planting the standard of the redemptive Cross of Jesus Christ, he marched forward seeking new fields of missionary enterprise.

Was there not fulfilled in him an allegorical prediction by the most gifted and sublime of the Hebrew prophets: "I will lead the blind by a way that they know not; in paths that they know not will I lead them." As he pursued the vocation to which he had been ordained he expanded into other functions, aspirations, occupations, which at first he had not contemplated. When he first went to Africa, the commission given to him contained no mandate to help or benefit the tribes of that country by any other means than teaching and preaching the way of peace by which God's erring children might return to Himself.

In the year 1856 he went to London to rejoin his wife and children, who for prudential reasons, mainly those of health and safety, had preceded him. The fame of his discoveries also had preceded him. Without losing his sense of moral responsibility as a teacher of Divine truth, he became a pathfinder into the very heart of Africa. It then was apparent to himself and many others that his path and his mission were being opened by a Power superior to his own, or that of any Missionary Society.

In the brief time allotted to me, I can only indicate a few of the salient points of his character or career. I do not propose to analyse the one or eulogise the other, beyond saying that he was an upright, humane, courageous man, willing to enter and follow with unwearying fortitude and unvarying consistency any path which congruent circumstances opened for him. In commemoration of his patient intelligence, his energy of spirit, his persistence of purpose, his freedom from egotism, many competent hands have combined to erect for him an illustrious monument of fame. Few men of British origin have been more talked about, more written about, more admired and eulogised.

During the year preceding his visit to England, the gold medal of the Royal Geographical Society had been awarded to him. On his arrival it was formally presented to him after a highly eulogistic speech by Sir Roderick Murchison. The London Missionary Society gave him a public reception, with the Earl of Shaftesbury presiding. Early in 1887, a welcome home was given to him in the Mansion House, by a large and brilliant assembly. Many eminent men described the toils and successes of the guest. He was made a Fellow of the

Royal Society. Oxford University conferred on him the degree of Doctor of Civil Law; Glasgow University made him LL.D. In Dublin he was feted by the British Association for the Advancement of Science. The citizens of Glasgow raised and presented to him a needed and deserved donation of £2,000.

Then, after ten years of missionary journeyings, he had revealed to the outside world of civilisation a great and grand territory, capable of large and lucrative development. Mr. Johnston, himself an explorer, in a "preface" to his book on Dr. Livingstone's travels and explorations in Central Africa, says:—"Until I travelled in Livingstone's footsteps, and entered minutely into the recorded details of Livingstone's work in Africa, I realised but feebly the debt which African civilisation owes to that great man, and the permanent and solid value of his careful researches into the physical conditions and natural history of the Dark Continent." Into that so-called Dark Continent the missionary pioneer carried the double light of Divine truth and human science. In 1857 he published his great book, "Missionary Travels and Researches in South Africa."

During those journeys Nature had exposed to his enchanted gaze marvels of beauty and utility—some of which no white man's eyes had ever previously surveyed, and about which no white man's heart had ever been excited. He had also gained closer and more intimate insight of the habits, languages, religious notions and instincts of numerous tribes, who were utterly unacquainted with the habits and modes of the life of civilised peoples. In his youth, in the land of his birth, he had made self-directed adventures in paths of science, and by attendance at night-schools had acquired knowledge which served him well in the wilds of Africa. In the speech by Sir Roderick Murchison, already referred to, he said:—"As the pioneer of sound knowledge, he had, by his astronomical observations, determined the sites of various places, hills, rivers, lakes, hitherto nearly unknown; while he had seized upon every opportunity of describing the physical features, climatology, and even geological structure of the countries which he had explored; and pointed out many new sources of commerce as yet unknown to the scope and enterprise of the British merchant."

It is in relation to his work of this kind that our Society is immediately concerned. The published reports of his travels, observations, researches spread over the scientific and mercantile classes of Europe with all the fascinating surprise of a new revelation. Those classes were startled, astounded, delighted. Here was a missionary who had outgrown his clerical garb; gone beyond the

bounds of conventional clerical functions; had made the world of trade and commerce his debtor; had won the grateful admiration of doctors and savants of distinction; had secured flattering encomiums and substantial honours in the land from which he had gone to Africa.

True, his achievements in geography, ethnology, physical science were not the principal objects for which he was originally commissioned to proceed to Africa. To some folk it may be a matter for surprise that the man who, in his youth, had studied with ardour to qualify himself for a sacred calling, should have permitted himself to be drawn aside from that vocation. It proves that he was willing to pursue any path which would lead to the most eminent service for humanity. Like Abraham, of old, who, when called, obeyed; he went out not knowing whither he went. To objectors his reply was :—" While I hope to continue the same cordial co-operation and friendship with the London Missionary Society, which have always characterised our intercourse, various reasons induce me to withdraw from pecuniary dependence on any Society."

The amazing wonders of a newly-discovered region of closely-peopled country largely absorbed the innate scientific tendency and the utilitarian perceptions of this new explorer. He was opening up to the gaze of the civilised world a new area of scientific research and trading possibility. He was the advance agent of civilisation, the pioneer of a highly developed system of occupation, development and progress. Africa had reached a turning point in its history.

The excitement caused in all spheres of life, commercial, political, scientific, by the publication of his journals, was not allowed to subside till the Government of the day had been induced to invest the intrepid explorer with new powers and equipment for the work which he was manifestly fitted to pursue. He was appointed British Consul for the Zambesi, with a salary of £500 a year. He was also given command of an expedition for the complete exploration of the territory, through which flows the noble river of South-eastern Africa; and for the discovery of the sources of the Nile.

We cannot follow his itinerary on his second and third expeditions for exploration. Time's limitation forbids. Mentally, at leisure, we may, if we will, picture him as the pathfinder through trackless regions, as the explorer of vast areas of country of unsuspected productiveness, as the discoverer of affluent natural resources which would, for centuries to come, contribute to the wealth and comfort of the world. Even now, after half a century has passed away, one may hesitate to estimate the value of the influence of such a life. It was a life that was always sincere; always carried the savour of

reverence. It was a life of daring adventures, of thrilling experiences, of manifold dangers, terminating in pathetic loneliness. It was tragical, when the emaciated form, worn down by sickness which would not be cured, sank slowly into the unwaking sleep of death, with only native servants near to give him help, or to comfort or succour him. During the last night of April, 1873, he passed out of human sight into the darkness of eternity, leaving behind him the brilliance of a noble life, and a carefully written diary of his experiences and achievements.

Early in the morning of May 1st, he was found by one of his devoted native followers beside his bed in the silent, moveless attitude of prayer. One of his servants glided with soft footfalls to his side, touched his cheeks; they were cold. His attitude was rigid; his eyes were sightless; his face was pallid; his spirit had fled. The many weary journeyings of David Livingstone were ended. Doubtless, while on his bent knees he committed his spirit to the Being who gave it, he passed to his reward as one of the great Father's "good and faithful servants."

His body was embalmed and taken to England. Now, after life's strenuous struggle with difficulties and dangers, it reposes in Britain's imposing Mansoleum of honoured dead, at Westminster. The venerated name on a memorial tablet will tell to generations of visitors that there lie the mortal remains of one of the most eminent in the glorious historic roll of notable enterprising Britons.

But the cold inanimate marble is not the only permanent material record of Dr. David Livingstone's life work. Inseparably linked with the name Africa is the name Livingstone. It is indelibly imprinted on the veldts, jungles and forests of the South-central portion of that great country. He compassed most of the great lakes of Central Africa, and his name sparkles in the silver sheen of Nyassa, Bangweolo, Nyanza, Tanganyika. It is impressed on the map of the country by the vivid red lines of the eminent British explorer's track from Zanzibar to Lake Nyassa, thence to the north end of Tanganyika, with many experimental turnings and twirlings in search of new wonders or new treasures. We find his name on a charming little island nestling on the breast of the expansive Zambesi in the very heart of Africa; there are his footmarks as he stood in profound admiration, gazing in rapture on the uptossed spray of tumultuous waters, as they dashed, aye, as they have roared, tumbled and dashed for incomputable ages, over the lofty cliffs, with the din and energy of an impetuous, interminable cataract. He was the first

British subject to view that stupendous waterfall. On the electric current of thought his mind shot back to home, to the Queen of the land of home, and of part of Africa, and with genuine loyalty he designated that wonderful natural phenomenon, "The Victorian Waterfall."

> "Lives of great men all remind us,
> We can make our lives sublime,
> And, departing, leave behind us
> Footprints on the sands of time."

OTHER HEROES IN MODERN EXPLORATION.

Now and then the pathetic conviction seizes us that we owe something to the heroic men who, at much personal inconvenience, hardship and peril, have pursued the objects which we, in our comfortable room here, have the calm pleasure of reviewing. Geographical discoveries are not made by men who sit month after month before a roller-top desk. Whether or not it is our bounden duty, it is meet and right that we should weave our cypress chaplet of regret, ornament it with the white flowers of admiration, and with it enwreath the memories of the men who have sacrificed themselves in the cause of geographical exploration. Our annual meeting is a fitting time in which to do this.

On 12th June last, the mortal remains of a respected Queensland explorer, Mr. Wm. Landsborough, were brought to Brisbane from Caloundra, where they had rested for 27 years. The next day they were re-interred with fitting ceremony in the cemetery at Toowong. The Council of this Society recognised the appropriateness of the transfer, and was represented officially at that suitable honour given to a courageous and enterprising Queenslander, who deserved well of his country. Towards the close of his career the Government made him a grant of £3,000. The identification of the well-preserved remains was verified. It may be hoped that by and by, over his grave there will be erected a memorial worthy of his patriotic services. In this connection I should like to express my hope, shared by many, that at some period, not too far distant, a substantial and permanent monument worthy of the services rendered to Australia by its leading explorers, will be erected in a conspicuous place in the capital city of this State. They did much for posterity, even within the territory, now constituting the State of Queensland; should not posterity do thus much for them? Sometimes the good work done by venturesome and intrepid explorers outlives their personal fame.

But this reproach of omitted recognition does not invariably apply. In this year we have a striking case in point. At one of our own ordinary meetings regret was expressed at the untimely fate

which had, in the flush of famous achievement, cut down some members, the leader himself included, of Captain Scott's expedition in search of the South Pole. Then, we had only meagre details of the accomplished object of that expedition, and of the terrible fatal fight with the savage elements of Nature in its wildest mood. All the subsequent information received has enhanced the reputable courage, persistency and determination of the explorers. Recognition of their heroic qualities came speedily and generously. The whole civilised world evinced its admiration of the heroism which struggled day after day with the fury of an irresistible Antarctic blizzard. Over rugged ice, through trackless snow, in constant gloom, breasting fierce wind, half-blinded by driven snow, the intrepid pursuers of a guerdon of fame at length reached their coveted goal, to find that some other hand had first touched the prize, and reaped the glory for which they had endured severest hardship and privation. But, although Captain Amundsen had won the race for the South Pole, he had not won all the honours of that achievement. Admiring nations have generously given their praise to the brave leader of the ill-fated British expedition and his devoted companions, whose final resting place lies far away in the eternal ice and snow which treated them so cruelly. The following is extracted from a London journal :—" The story of Captain Scott's successful journey to the South Pole, and of his death with his four brave companions on the Great Ice Barrier of the Antarctic, was told by Commander E. R. G. R. Evans, R.N., C.B., at the Royal Albert Hall. The meeting was confined to members of the Royal Geographical Society and their friends, but every seat in the great hall was occupied. They had met to welcome the survivors of the Expedition, and, as Lord Curzon said in his introductory speech, to hear from the lips of their commander the record of the expedition which culminated in such mingled triumph and disaster, but which will be for ever remembered, not merely for its crowning tragedy, but for its splendid tale of work accomplished and results achieved. Lord Curzon presided."

The mention of geography in the international slaughterous times through which Eastern Europe has recently passed brings to mind scenes of carnage and cruelty which are demarcating anew the lines of national territories. With the amazingly rapid contraction of the Turkish power, which 500 years ago cut its way through Europe with blood-stained scimitar, boundary lines are being altered, and the map of the Baltic region is being re-modelled. The school-boy will need a revised map of the Balkan Peninsula. I assume that few, if any, of my hearers to-night will regret that a force of despotic oppression and merciless intolerance has been suddenly curtailed.

Too long has that Muscovite incubus repressed the racial political and religious aspirations of Slavs and Serbs in that region. All previous efforts to throw off that incubus have been futile. They have been repressed remorselessly and revenged savagely. At last the giant has renewed its strength and its vigour. Aye, four of those subjected Powers have sundered the fetters of their political thraldom and hurled the detested tyrant from the loftiest pinnacle of his glory. They have won the right to restrict his boundaries and enlarge their own. The Turkish Sultan is now the ruler in Europe of a much reduced area of territory on the shore of the Dardanelles and the Bosphorous, where he must pay heed to the united voices of the great European Powers.

It is 450 years since Servia was conquered by Sultan Mahomet; it is over 500 years since Bulgaria was conquered by Turks. It was at a later period that Montenegro came under the blighting dominancy of the Ottoman power. In 1861 a Servian rising was ruthlessly crushed. In 1876 angry cries of indignant protest from all parts of Europe, from America and Australia, were made against the ferocity with which the Turkish soldiery revenged an attempt by the Bulgarians to escape from the harsh exactions, and the cruel treatment of "The Insufferable Turk."

The fourth power is Greece. Greece revived and revivified, after well nigh two thousand years; rising Phœnix-like from the ashes of a glorious past which seemed defunct, and was decrepit. Now, the rarest of Rip Van Winkles is coming from the historical cemetery of shrouded glories to awaken modern interest in its ancient renown. Think of its romantic poetry and classic art; its military achievements 2,500 years ago at Marathon, Salamis, Thermopylœ; think of the poems of Homer, Horace and Hesiod; the orations of Demosthenes and Socrates; the statesmanship of Plato. Yes, think of that land of rhythmic legend, of elegant sculpture and architecture, of Temples dedicated to the adoration of Aphrodite at Corinth, of Venus at Athens. It has been said that at Corinth and Athens "the arts and sciences flourished in unrivalled splendour." Once more, it has resumed its suspended gallantry, and under the leadership of a valorous monarch, has recovered its lost renown and some of its lost territory. Alas! that in the hour of his military triumph the victorious King should have fallen a victim to an assassin's malignity!

For centuries the merciless bigotry of the Turks has, like a pestilence, devastated the Christian countries of Europe. In 1822 no less than 40,000 Greeks were massacred on the Isle of Chios. In 1876, a mad wave of Turkish extermination swept over Bulgaria,

and women and children were subjected to atrocious cruelty and slaughter. Numerous efforts have been made to throw off the misrule and cruelty of the yoke. In all the world there is not a more intolerant religious spirit than that which pervades all ranks and races in the Mohammedan portion of the world.

Now has come the time for the retrieval of territorial possessions and autonomous government over some of the long lost boundaries. The down-trodden States within that area have concluded that the crescent of fanatical oppression is waning, and the dawn of renewed and happier destiny has come, bringing a revival of hope and a resuscitation of energy and courage. The old martial fire has been rekindled; the old national gallantry has renewed its youth. A new monarchical dynasty has infused a new spirit in one or two of them. They have been impelled by an ambition to repeat the heroic deeds depicted by dramatists of ages long past, and sung with enthusiasm by patriotic poets of the same by-gone period.

Alas! that when, by a concerted effort of plucky warfare, the fanatical despotism had been thrown off the allied conquerors should have quarelled over the spoils of victory, and have besmudged the fame of their splendid achievement by deeds of barbarism, which have stirred the indignation of their well-wishers and friends. Could anything in warfare be more deplorable for allies, who had co-operated with irresistible heroism to cast off an alien, cruel, and detestable despotism than to fight ferociously over the spoils of conquest? In this rancorous and vindictive quarrel there was a sad display of ruthless disregard for each other's life and property. The homes which they had protected against the common Turkish foe they themselves destroyed and desolated.

In the darker aspects of that unchivalrous contest there is a gleam of light. International questions of the most intimate and delicate nature were in peril. Without wise self-restraint on the part of the Great European Powers there might have been ruinous hostilities over a great part of Europe. No doubt the dread of such an outbreak constrained the six ruling powers, in whose hands lay the destiny of nations, to strive to the utmost to confine the war to the Balkan region and the Balkan nations. This they succeeded in doing. It must be gratifying to all British people that at such a crisis the Foreign Relations of Great Britain were in such cautious and capable hands as those of Sir Edward Grey, whose statement in the Commons on the crisis has won universal encomiums.

ROBERT FALCON SCOTT—CAPTAIN R.N.

Born at Devonport, England, June 1868; died on return journey from South Pole, about 29th March, 1912; aged 44 years.*

BY GEORGE PHILLIPS, C.E., F.R.G.S.A.Q.

For three centuries and a half Englishmen have sought with varying success, and sometimes with dire disaster, to pierce the Arctic circle, and some have even sought to reach the North Pole,—while, since 1839, similar efforts have been made by our adventurous countrymen in the Antarctic.

The science of Polar exploration—like other things—has been of slow growth, but the greatest factor—so far as efforts to reach the Poles are concerned—has been the commercial development of petroleum, whereby the requisite fuel in compact form has been made available.

But little more than three years ago, the foot of man—in spite of the most determined efforts—had never been set on either Pole, and now both Poles have been conquered,—the North by Commander Peary of the United States Navy, after 23 years of struggles and discouragements that would have broken the heart of any ordinary man,—and the South, first by Roald Amundsen on 16th December, 1911†, and only thirty-two days later by Scott, on 17th January, 1912.

These three men—Peary, Amundsen, and Scott—sprung from the same or similar Northern stock, and so far as physical, mental, and personal qualifications go, were probably equally well fitted for the work of Polar exploration, but Peary had nearly a quarter of a century of almost continuous arctic experience before he attained his goal at the age of 53.

*Royal Geographical Society of Australasia, Queensland, April 11th, 1913.

†Amundsen returned to his winter quarters on the 25th January, 1912, only eight days after Scott reached the Pole.—G.P.

Amundsen was born and reared amidst the snow and ice of Norway —he could run on ski, and had besides served a long apprenticeship in the Arctic before he made his successful dash to the South Pole; while Scott had only Antarctic experience, and does not seem to have fully realised, as Peary and Amundsen did, the supreme value of dogs for the work he had in hand.

Surely horses or mules—no matter how hardy or how well cared for—were never intended by nature for such work as Scott and Shackleton expected from them, whilst both trusted far too much to the physical strength and stamina of themselves and their men.

Scott was the product of the Royal Navy, which he entered at 14 years of age, and rose to the position of post Captain. He was the sort of man who, in a naval engagement, would have nailed his flag to the mast,—would have conquered or died.

Scott conquered the South Pole as he fully determined to do when he left England, and if he had had five or six good dog teams he would in all human probability have triumphed gloriously, and returned in safety to his base. That he so nearly succeeded in doing so, in spite of so many unexpected difficulties, and in spite of his unsuitable equipment, so far as animal traction is concerned, is a remarkable tribute to his skill, determination and endurance.

THE EXPEDITION.

In the absence of Scott's journals, it is impossible to give more than a mere outline of the work done.

The "Terra Nova," with the members of the Expedition—chiefly Royal Navy men—left London on 1st June, 1910, under Commander Evans, R.N. Two months were occupied on the voyage to Cape Town, during which valuable magnetic observations were taken. At Cape Town, Scott joined the ship, which reached the base of operations on the edge of the great ice barrier in December, 1910. Operations were at once begun to carry out the leader's programme.

Leaving the main party at McMurdo Sound, the ship went eastwards along the face of the ice barrier for 400 miles, in order to land a party on King Edward VII. Land, with a view to exploration of that part of the Antarctic which is practically unknown. The party were unable to effect a landing, and on their return met the "Fram" in Balloon Bay, thus learning for the first time the presence and intentions of Captain Amundsen.

The party which was to have explored King Edward VII. Land, proceeded to Cape Adaire, whence exploration was to be carried on along the coast on the sea ice. At the base of the expedition, at

Hut Point, arrangements were made for an extensive scheme of scientific operations, all of which were carried out with exceptional completeness. During the short polar summer of 1910-1911 the working parties were fully occupied in the arduous but necessary work of laying out stores of food and fuel at frequent depots, to serve not only the return journey, but also to a less extent the outward one.

Then followed the long polar winter of 1911, when the members of the expedition were compelled to keep close to winter quarters.

THE START FOR THE POLE

The party finally selected for the dash for the pole comprised,—CAPTAIN ROBERT FALCON SCOTT, R.N., leader ; DR. EDWARD ADRIAN WILSON, principal scientific member of the expedition, who had been a member of Scott's first expedition 10 years previously ; LIEUTENANT HENRY R. BOWERS, of the Royal Indian Marine, Commissariat Officer, whom Captain Scott described as the life of the expedition ; CAPTAIN LAURENCE EDWARD GRACE OATES, 6th (Inniskilling) Dragoons, who was in charge of the ponies and mules, and PETTY OFFICER EDGAR EVANS, who was the champion athlete of the Navy, and who stood over 6 feet in height.

Scott originally laid his plans for a party of four, but owing to the failure of the animal transport, he finally decided to take an additional man.

The party left Hut Point (some 700 miles from the Pole) on 2nd November, 1911, and on December 10th reached the Beardmore Glacier, the most formidable obstacle to be overcome. On 21st December the party were on the plateau 8,600 feet above sea level. Here they sent back their dogs, and Scott and his companions dragged the sledges all the way to the Pole.

The last supporting party left Captain Scott and his four companions in excellent health and spirits, on January 4th, 1912, in 87° 35′ South, only 150 miles from the Pole.

The Pole was reached in 14 days, where Captain Amundsen's tent and records were found—thus proving beyond a doubt that both the Norwegian and the British parties reached the Pole. It will be observed that on the outward journey it took Scott 78 days from his base at Hut Point to cover 700 miles, or an average of nine miles per day, which, under the circumstances, must be regarded as fair going. Allowing that Scott remained two days at the Pole for purposes of observation, and that he could cover 12 miles per day with the lighter loads on the return journey, he might have expected to return to Hut Point on the 20th March ; and doubtlesss he would

have done so but for the unforeseen misfortunes, and the exceptionally severe weather encountered. These difficulties and misfortunes can best be told in Scott's own words, penned by him during the fatal blizzard on March 25th, only 155 miles from his base at Hut Point, and only 11 miles from "One Ton" depot, where there was an ample store of food and fuel.

SCOTT'S LAST MESSAGE.

(In the tent where Captain Scott waited eight days for death with Dr. Wilson and Lieutenant Bowers, the search party found the leader's diary, in which Captain Scott wrote, on March 25th, 1912, this explanation and appeal :—)

The causes of this disaster are not due to faulty organisation, but to misfortune in all risks which had to be undertaken.

(1) The loss of pony transport in March, 1911, obliged me to start later than I had intended, and obliged the limits of stuff transported to be narrowed.

(2) The weather throughout the outward journey, and especially the long gale in 83 deg. south, stopped us.

(3) The soft snow in the lower reaches of the glacier again reduced the pace. We fought these untoward events with a will, and conquered, but it ate into our provisions reserve. Every detail of our food supplies, clothing, and depots made on the interior ice-sheet, and on that long stretch of 700 miles to the Pole and back worked out to perfection. The advance party would have returned to the glacier in fine form and with a surplus of food, but for the astonishing failure of the man whom we had least expected to fail. Seaman Edgar Evans was thought the strong man of the party, and the Beardmore Glacier is not difficult in fine weather. But on our return we did not get a single completely fine day. This, with a sick companion, enormously increased our anxieties.

I have said elsewhere we got into frightfully rough ice, and Edgar Evans received a concussion of the brain. He died a natural death, but left us a shaken party, with the season unduly advanced.

But all the facts above enumerated were as nothing to the surprise which awaited us on the barrier. I maintain that our arrangements for returning were quite adequate, and that no one in the world would have expected the temperature and surface which we encountered at this time of the year.

On the summit in lat. 85 deg. to lat. 86 deg., we had minus 20 to minus 30.

On the Barrier in latitude 82 deg., ten thousand feet lower, we had minus 30 in the day, and minus 47 at night pretty regularly, with a continuous head wind during our day marches.

It is clear that these circumstances came on very suddenly, and our wreck is certainly due to this sudden advent of severe weather, which does not seem to have any satisfactory cause.

I do not think human beings ever came through such a month as we have come through, and we should have got through in spite of the weather but for the sickening of a second companion, Captain Oates, and a shortage of fuel in our depots, for which I cannot account, and finally but for the storm which has fallen on us within eleven miles of this depot, at which we hoped to secure the final supplies.

Surely misfortune could scarcely have exceeded this last blow. We arrived within eleven miles of our old "One Ton" camp with fuel for one hot meal, and food for two days.

For four days we have been unable to leave the tent, a gale blowing about us.

We are weak, writing is difficult; but for my own sake I do not regret this journey, which has shown that Englishmen can endure hardship, help one another, and meet death with as great a fortitude as ever in the past.

We took risks—we know we took them. Things have come out against us, and, therefore, we have no cause for complaint, but bow to the will of Providence, determined still to do our best to the last.

But if we have been willing to give our lives to this enterprise, which is for the honour of our country, I appeal to our countrymen to see that those who depend on us are properly cared for.

Had we lived, I should have had a tale to tell of the hardihood, endurance, and courage of my companions which would have stirred the heart of every Englishman.

These rough notes and our dead bodies must tell the tale; but surely, surely a great, rich country like ours will see that those who are dependent upon us are properly provided for.

(Signed) R. SCOTT,

March 25th, 1912.

COMMANDER EVANS' ACCOUNT OF THE FINDING OF THE SOUTHERN PARTY.

The return of the Southern (Scott's) Party was expected at Hut Point about March 10th, 1912.

To assist them Mr. Cherry Garrard and the dog-driver, Dimitri, with two dog teams, were sent out at the beginning of March.

This relief party reached " One Ton " depot on March 3rd, but was compelled to return on March 10th, owing primarily to the food for the dogs running short, and also to the persistent bad weather, and the poor condition of the dogs after the strain of a hard season's work.

The dog teams returnd to Hut Point on March 16th, the poor animals mostly frost-bitten and incapable of further work. Mr. Cherry Garrard collapsed as the result of having over-strained his heart, and his companion was also sick.

Surgeon Atkinson and Petty Officer Keohane, the only two men left, then fought their way out to Corner Camp against the unusually severe weather, and realising that they could be of no assistance, were forced to return, after leaving one week's supply of provisions at the depot.

THE FINAL SEARCH.

The final search party, in two divisions, left Cape Evans after the winter,—on October 30th, 1912. Provisions were taken for three months, it being anticipated that an extended search would be necessary.

" One Ton " Camp, 144 miles from the base, was found to be in order, and all provisioned. Then proceeding along the old Southern route, Mr. Wright's party, on November 10th, sighted Captain Scott's tent.

Within it were found the bodies of Captain Scott, Dr. Wilson, and Lieutenant Bowers.

It was evident from the records found in the tent that the first death to occur was that of Seaman Petty Officer Edgar Evans. Evans died a natural death on February 17th, at the foot of the Beardmore Glacier. His death was accelerated by a concussion of the brain, sustained whilst travelling over rough ice some time previously.

Captain Oates was the next to be lost.* His feet and hands were badly frost-bitten, and although he struggled on heroically, his comrades knew on March 16th that his end was approaching. He had borne intense suffering for weeks without complaint, and he did not give up hope to the very end.

Captain Scott wrote of Oates :—" He was a brave soul. He slept through the night, hoping not to awake, but he awoke in the morning. It was blowing a blizzard. Oates said, ' I am just going outside, and I may be some time.' He went out into the blizzard,

*Captain Oates went out to his death on his 32nd birthday.—G.P.

and we have not seen him since. We knew," continued Scott, "that Oates was walking to his death, but though we tried to dissuade him, we knew it was the act of a brave man and an English gentleman."

After Oates' gallant death, Captain Scott, Dr. Wilson and Lieutenant Bowers pushed Northwards as fast as the weather (which was abnormally bad) would let them, but they were forced to camp on March 21st, eleven miles South of the big depot at "One Ton" Camp. This they never reached, owing to a blizzard, which is known from the records to have lasted nine days. When the blizzard overtook them their food and fuel gave out.

THE BURIAL SERVICE.

After the discovery of the bodies, Surgeon Atkinson (who was in charge of the relief expedition) gathered the records and the effects of the dead men, read the burial service over their bodies, and erected a cairn and cross to their memory over the inner tent, in which they buried them.

The party then searched for 23 miles to the South, endeavouring to discover the body of Captain Oates. It was never found, but another cairn and record were left in the vicinity to his memory.

The Southern party nobly stood by their sick companions to the end, and in spite of their distressing condition they had retained every record and 35 pounds weight of geological specimens, which prove to be of the greatest scientific value.

Thus perished all that was mortal of Scott and his four comrades. In the execution of their duty they displayed a disciplined fortitude that rose superior to every calamity, even death itself—a fortitude not tested in some fierce and heady fight of brief duration, but sustained from day to day for more than two months against intense cold, hunger, pain, weariness, and all the destructive agencies of Nature in its fiercest and most forbidding aspect.

KILLED IN ACTION.

The following communication has been issued by the Admiralty :—

"It is with profound regret that the Lords Commissioners of the Admiralty have received the following telegram from Commander Evans :—

'Regret report deaths of Captain Scott and Petty Officer 1st class Edgar Evans, official number 160225, 29th March and 17th February, 1912 respectively.'

" The circumstances in which Captain Scott and his comrades lost their lives prove the constancy and resolution with which they carried out the duty for which they volunteered. Their Lordships consider that their loss should be regarded *as if they had been killed in action*, and their story will long be remembered with honour by the Navy."

IN MEMORIAM.

CAPTAIN SCOTT, R.N.

AND HIS GALLANT COMRADES.

Who reached the South Pole in January, 1912,
and died on their homeward way.

Not for the fame that crowns a gallant deed
  They fixed their fearless eyes on that far goal,
Steadfast of purpose, resolute at need
  To give their lives for toll.

But in the service of their kind they fared,
  To probe the secrets which the jealous Earth
Yields only as the prize of perils dared,
  The wage of proven worth.

So on their record, writ for all to know—
  The task achieved, the homeward way half won—
Though cold they lie beneath their pall of snow,
  Shines the eternal sun.

O hearts of metal pure as finest gold!
  O great ensample, where our sons may trace,
Too proud for tears, their birthright from of old,
  Heirs of the Island Race!

O.S.

" Punch," February 19th, 1913.

A REVIEW OF ANTARCTIC EXPLORATION.*

BY DR. J. P. THOMSON, Hon. Secy. and Treas., R.G.S.A.Q.

While the story of Polar tragedy in both hemispheres of the globe should be written in tears, and punctuated by heart pangs, the narratives of Scientific exploration and discovery in the Arctic and Antarctic regions are no less pathetic, no less inspiring, and no less thrilling.

No other chapter of human history so directly appeals to the sympathies of man, whose very soul is stirred to enthusiasm by the tales of adventure and heroic achievements that have characterised most of the Polar enterprises of past centuries down to the present times. There is something fatally irresistible in the call of the ice fields, and there is a peculiar fascination within the regions of eternal snow. Hunger, fatigue, intense cold, starvation, exhaustion and death itself are not enough to deter brave and resolute men from exploiting grim Nature's storehouse to add to our knowledge of those storm-swept regions. The history of Australian exploration and discovery, as we all know, is associated with many sad tales of the intense heat of the central desert, and the loss of brave men who have perished from hunger and thirst. In Africa, too, and in other inhospitable places similar tales have been told, but nothing so harrowing and nothing so intensely painful, so profoundly pathetic as the many disasters that have occurred within the memory of man in the far off North and South.

The modern polarlust is an insidious and dangerous malady, and no adequate return can possibly compensate for the loss of life, intensity of human suffering, expense and consumption of energy involved, in the international struggle to reach the terrestrial poles. The aim of all legitimate polar enterprise should be the acquisition of knowledge, and this, it is gratifying to know, was the object of the British Expeditions to the South. Not merely " a dash to the South Pole," but in the words of Sir John Murray, " to determine the nature

*Royal Geographical Society of Australasia, Queensland, April 11th, 1913.

and extent of the Antarctic continent, to penetrate into the interior, to ascertain the nature and depth of the ice-cap, to observe the character of the underlying rocks and the fossils, to take magnetic and meteorological observations both at sea and on land, to observe the temperature of the ocean at all depths, to take pendulum observations, to sound, trawl, and dredge."

But these objects of modern Antarctic exploration are not always kept in view. Animated by the spirit of adventure or fired by the desires of rivalry, explorers make the Poles of the earth the goal of their ambition, and all other considerations are subordinated to this consuming desire, with results not always too satisfactory, and occasionally disastrous, there being little added to our common store of knowledge. In the recent Norwegian Antarctic Expedition, the objective was frankly a dash to the Pole, but with Captain Scott the "main object was scientific research with an advance to the Pole as an incident." It may indeed be said that the incident was of great importance, but "not vital to the success of the expedition." In both enterprises the plan of attack on the Pole differed very considerably. Depending on methods of transport, tried and abandoned by recent British expeditions, Captain Amundsen "placed his whole reliance on dogs and ski, while Captain Scott preferred the use of ponies for his sledges on the Barrier surface, and haulage by men on the high Plateau." The latter, "therefore, resolved that the journey from the foot of the Glacier to the Pole, a distance of 1,200 miles there and back, should be done by himself and his men dragging their own provisions and constant weights." In discussing the question, Captain Scott said,—"Dogs greatly increase the radius of action, but to pretend that they can be worked to this end without pain, suffering and death is futile. Such sordid necessity robs sledge travelling by dogs of much of its glory. In my mind, no journey ever made with dogs can approach the height of the fine conception which is realised when a party of men go forth to face hardships, dangers, and difficulties with their own unaided efforts, and by days and weeks of hard physical labour succeed in solving some problem of the great unknown. Surely in this case the conquest is more nobly and splendidly won." In the light of more recent events there can be no doubt whatever that Scott was animated by the true British spirit of enterprise, his ideals being of the highest order, his conception lofty, his courage dauntless, and his resolution unconquerable, but the simple fact of Amundsen having successfully accomplished his journey to the Pole and back in an incredibly short space of time, without the loss of a single man or disaster of any kind, will be sufficient

to impress his successors in the field of Antarctic exploration and discovery with his ideas of organisation and transport. In referring to the narrative of this Norwegian Expedition, my friend, Dr. H. R. Mill says,—" It gives the impression of a rollicking time, and the predominant feeling, after reading the whole book, is that we have been following the exploits of a set of healthy, well-fed holiday-makers, in the keen enjoyment of winter sports and rough yachting. There is not a word of privation or suffering at all; the snow-blindness, frost-bite, and other slings and arrows of the Polar regions were simply laughed at. It is a remarkable fact that there was no medical man on the Expedition, and extremely fortunate that the necessity for surgical assistance did not arise."

The history of Antarctic voyages covers a period of almost two hundred years, going away back to the year 1716, when Le Gentil de la Barbinais reached 61° 30′ South latitude. Others followed during the succeeding years, including the immortal Captain Cook; in 1772-75, Commander Wilkes of the United States Navy in 1838-40; Sir James Clark Ross in 1839-41; and Sir George Nares in 1874, the last of these in the "*Challenger*," being the first to cross the Antarctic circle by steam and reach the parallel of 66° 40′. But it was Ross in the *Erebus* and *Terror*, who discovered Victoria Land, circumnavigated in high latitudes and reached a farthest South of 78° 10′, in longitude 161° 27′ W. He was, however, preceded by John Biscoe, 1830-32, in the brig *Tula*, accompanied by the cutter *Lively*, who also made a circumnavigation in high latitudes, but the farthest South reached was only 67° 15′. After an interval of 18 years Nares was followed by the Dundee Whaling Fleet, consisting of the *Balaena*, *Active*, *Diana*, and the *Pole Star*. Louis Philippe Land was visited, and scientific observations were carried out by William S. Bruce and Charles W. Donald. The year 1898 may, however, be regarded as the beginning of the new era of Antarctic Exlporation, the *Belgica* having drifted in the pack ice "throughout the first Antarctic winter ever experienced by man." In the following year, C. E. Borchgrevink, a former Queensland Surveyor's axe-man, in the *Southern Cross*, fitted out by Sir George Newnes, landed at Cape Adaire, and wintered for the first time on the Antarctic continent. But with the exception of effectually showing the possibility of enduring the rigours of winter climate in the far South, there was little added to our store of knowledge of Antarctica proper by these two expeditions.

It is, however, to the succeeding enterprises, initiated in 1901, that we are indebted for our immensely increased knowledge. Of these, there was first of all the international expeditions of the

Discovery under Captain Scott, the *Gauss* under Professor E. von Drygalski, and the private expeditions of Dr. Otto Nordenskjold in the *Antarctic*, Dr. Bruce in the *Scotia*, Dr. Jean Charco in the *Francais* in 1904, and in the *Pourquoi Pas?* in 1909. At the same time (1909) Sir Ernest Shackleton in the *Nimrod* was operating in South Victoria Land, where he reached and located the South Magnetic Pole, made the first ascent of Mount Erebus, and travelling South over the Barrier surface and plateau beyond, at an elevation of about 10,000 feet, succeeded in reaching the parallel of 88° 23′, where the loss of all the transport animals and consequent impending starvation compelled a return of the party, though only 113 miles from the Pole. Such alas is the irony of fate.

The Discovery Expedition, in which Queensland was interested to the extent of £1,000 hard cash, being the amount the Government of the day, at my instigation, so generously contributed towards the enterprise, was designed for extensive scientific research, and may be said to have added more to our knowledge of Antarctic geography than all its predecessors. The epoch-making journeys then carried out by Captain Scott under enormous difficulties of transport and improper food, will rank as first of the kind in the history of Polar exploration. In his first year's journey South he reached a point 380 miles from his base in latitude 82° 17′, where crevasses and disturbed ice were encountered as the party approached the mountains. In the following year, a second great journey enabled Scott to find a way through the mountain range to the high plateau beyond, where an altitude of over 9,000 feet was reached, and a detailed knowledge of the Victorian Mountains obtained, the distance from the ship being 380 Miles. This Discovery expedition, associated with appalling hardships and difficulties, had spent two winters nearer the South Pole than any of its predecessors, securing to the world at large an immense increase of our geographical knowledge.

The second decade of the revival in South Polar exploration commenced with the summer 1911-12, when a greater number of expeditions entered the Antarctic ice-fields than previously. Captain Scott, in the *Terra Nova*, was again on the scene of his former activities, in command, so we are told by Sir Clements Markham, of "the best equipped expedition for scientific research that ever entered the Polar regions." As the tragic end of the heroic leader of this ill-fated expedition, and his brave and loyal comrades in misfortune, will form the subject of another address by my esteemed colleague, Mr. Phillips, little more need be said by me further than to add that Scott reached the Pole only to find the Norwegian flag planted there a month earlier

by Captain Amundsen. "But he was too good a fellow," said Lieut. Evans, "to take it too much to heart. The man who wrote in his dying message of bowing to the will of Providence was not likely to feel beaten by that." Still, he must have felt greatly disappointed. It would hardly be human to feel otherwise, no matter how good a fellow one might be. But the organisation of Amundsen's plans was as near perfection as possible, nothing being left to chance, as could plainly be seen by those who attended his lectures in Brisbane. He and his companions are expert ski-runners, and some of them, it is almost needless to say, are also expert dog-drivers. They all had the great advantage of previous experiences both in the Arctic and Antarctic, and the records of former expeditions on the Barrier ice must have contributed greatly to the success of their enterprise. Relying mostly on frozen seal-meat, of which great stores were collected along the Barrier front, it was found there was no need to economise food, and they travelled southward over the easy-going ice surface on an average of 20 miles per day till they reached the Pole, on December 16th, 1911, at an altitude of 10,500 feet above sea level, their path being up the Devil's Glacier between summits of from 12,000 to 15,000 feet high, and on to the Polar Plateau, the highest point of which was found to be 10,750 feet, near the 88th parallel. The return journey was accomplished without any difficulty, and the party with eleven dogs arrived at the ship on January 25th, 1912, in perfect health, after travelling 1,700 miles both ways. About the same time, Lieut. Filchner was operating in the Weddell Sea, a Japanese Expedition was at a point on the Barrier near King Edward Land, and Dr. Mawson's two parties had landed on the continent at Wilkes Land, where they are now continuing the season's work. But, unhappily, the recent sad news of the death of members of Dr. Mawson's staff makes us anxious as to the success and welfare of those left behind to face the rigours of the long Antarctic winter, and the dangers and privations associated with Polar Exploration. This, however, is how matters stand at present, and we can only hope that our anxieties may be groundless.

THE PANAMA CANAL.

Its Geographical Relations and Economic Uses.*

BY HON. F. T. BRENTNALL, M.L.C., President R.G.S.A.Q.

To-night the following questions might be considered appropriate :

Does this proposed consideration of the gigantic work now in progress in the Isthmus of Panama concern the essential character and aim of this Society ? Does the treatment of such a material project harmonise with our primary object ? (In what form and at what points does it touch and affect geography ?)

The completion of this phenomenal construction will mean :—

I.—The diminution of geographical distances in the matter of international transit ;

II.—The opening out of a new maritime way for connecting three continents ;

III.—The correlation of these conditions to improved facilities for international commerce.

In looking at this subject we are contemplating a stupendous operation on which the eyes of the civilised world are fixed, I regard this undertaking as a cut into the very heart of physical geography. Consider it as a great surgical operation intended to improve the health of the world's commerce. It is really the severance of a great continent into two distinct parts, each having its distinctive physical and ethnological features, without injury to the vitality of either part. A huge gaping gash is being incised with the object of promoting a healthier condition of the social, political and commercial relations of Europeans, Americans and Asiatics.

In many connections the Americans have a habit of using descriptions and definitions which are more forcible than elegant. Some of them call this canal "a great ditch." The vast array of waggons used to convey earth and stone from places where it is not

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*Anniversary Address to the Royal Geographical Society of Australasia, Queensland, August 18th, 1913.

needed, to places where it is required are styled "dirt cars." The magnitude of the undertaking may be surmised when it is learned that the earth to be removed would fill "dirt cars" enough to constitute a train 96,000 miles in length. Such a train would be nearly equal to four times the earth's circumference. Employed on this enormous job are roundly 10,000 whites and 25,000 coloured men. The expenditure is estimated at £80,000,000. In passing, it may be mentioned that the great iron road through Siberia, by which Russia has connected Northern Europe with Northern Asia, cost a similar amount. The Suez Canal, which is 99 miles long, cost 24 millions sterling. This, not more than half that length, will cost three times as much.

Before entering on the task of forming this canal, the Government of the United States insisted on the surrender by the Republic of Panama of a strip of territory, ten miles wide, right across the Isthmus. This is designated "The Canal Zone." The canal itself will be 40 miles in length, but at each end it will have to be cut through sandy shallows of five miles, or thereabouts, respectively. The severance of the American Continent by a navigable waterway has been the day-dream of covetous adventurers for several past centuries. Its prospective advantages were recognised. Its immediate difficulties deterred action. To timid men the magnitude of the task was a bugbear. The Spaniards sought wealth by easier and swifter methods of acquisition. There was a lot of buccaneering in those times; but they called it by the milder name of privateering.

The Spanish ships, often freighted with gold and gems, were chased, often caught, by British and French privateers. In those days of sea piracy the enterprising spirits of Europe found more exciting occupation than cutting canals. The choice of a canal route was a difficulty. Many travellers and surveyors preferred the Nicaraguan route to that of Panama. In the first half of the 16th century there were fierce quarrels over several different routes. People who quarrel much seldom do much else. Indeed, it has been said that when England began to contest with Spain for the supremacy of the seas, the Spanish authorities decided that it would be going in the face of Divine Providence to connect by a canal two seas which the Creator had set apart in the order of Nature. Men had yet to learn that Nature's designs have to submit to human ingenuity and to serve human needs.

In the 18th century Great Britain keenly desired a short route to the alluring slopes of Western America. At that period Nelson was harrying French and Spanish ships in the Caribbean Sea. The

British Government had given him the command of an expedition to the Isthmus of Panama. It seems to have had a twofold object,—to retaliate on Spain for declaring war on Great Britain, and to inspect the Isthmus for a suitable waterway to the Pacific Ocean. In a despatch from the locality he wrote :—" In order to give it to the great object of government, I intend to possess the Lake of Nicaragua, which, for the present, may be looked upon as the inland Gibraltar of Spanish America. As it commands the only water-pass between the oceans, its situation must ever render it a principal post to insure passage to the Southern Ocean, and by our possession of it Spanish America is divided in two." His plan failed, because he had started on that campaign in the wet season, and fever wrought havoc among his troops. Both French and Americans kept this project in pickle for many years. In 1884 a convention was agreed on between the American Secretary of State and the Nicaraguan Minister at Washington for a canal to be held and controlled jointly by the two countries. Five years later the American Congress granted a Charter for this work to a Maritime Canal Co. For three years the work went on, then the company failed.

The first earnest attempt to cut a waterway through the Isthmus of Panama was made by the French, at the loss of heaps of money Somewhere in the later seventies of the 19th century, De Lesseps, exultant at the success of his Suez achievement, appeared on the Panama scene. That success had given him fame. He was then eminently popular in France. The wizardry of his name and notability was enough to magnetise the gold from the pockets of his countrymen. He obtained a concession from the Government of the Panama Republic, and began his task. The original estimate of cost was £25,000,000 That estimate was far exceeded before a sufficient amount of work had been done. In 1888 capitalists became shy of the rapacious speculation. Small investors were alarmed at the enormous outlay. Resources were exhausted, so were patience and confidence. The fascinating device of a lottery failed to enchant. The great company became strangled by debt when the canal was not more than half completed. The disastrous failure was followed by ruin and tragedy. The hero of the Suez Canal was himself prosecuted, and his son shared his ignominy.

Then was coming the opportunity of the United States of America. Amongst its people there had been much dissatisfaction at the intervention in Central America of any European Power. But, in spite of protest, the French, whose convention had yet some

years to run, put on another financial spurt. It was plucky but futile. After spending more money, to the extent of £3,000,000, all seemed to be vanity and vexation of heart.

Years of supine irritation passed away. There was no cessation of American yearning for a shorter, easier, and more payable way to the western side of the American continent and the "Far East." We need not follow the protracted and embittered negotiations which took place between France and America for the sale of the former's rights in the convention and the large amount of work already done. At that time the French Company's accumulated liabilities amounted to the enormous sum of £70,000,000. It was hopelessly involved, and every effort to raise funds met with failure. On the 4th February, 1889, a receiver was placed in possession of the assets. After some years all difficulties in the way of a treaty between the United States and Columbia were overcome, after the two had been on the verge of war. In 1904, the United States entered into a convention with Panama. In 1905 a large meeting of "The International Board of Consulting Engineers" was held at Washington. At that meeting the type of canal to be constructed was decided upon. Active measures soon followed.

But first, there were matters to be arranged between America and Britain; for scarcely in any large part of the world can there be a hot pie but Britain has a finger in it. She had now to speak with a voice that meant to be heard. Some of her West Indian possessions stand as sentinels not far from Colon, on the Atlantic side of the Isthmus, guarding access by all routes to the entrance to the canal, on that side.

Negotiations between America and Great Britain culminated on 1st November, 1910, in the ratification and signing of the Hay-Pauncefort Treaty, which, at the present time, owing to selfish claim by some of the American people, is the subject of serious, exciting and irritating dispute.

It may help our friends to follow this fervid contention if two of the sections of that treaty be here quoted. They are these :—

"1. The canal shall be free and open to the vessels of commerce and of war of all nations observing these rules, on terms of entire equality, so that there shall be no discrimination against any such nations, or its citizens or subjects, in respect of the conditions, of the charges of traffic, or otherwise. Such conditions and charges of traffic shall be just and equitable.

"2. The canal shall never be blockaded, nor shall any right of war be exercised, nor any act of hostility be committed within it. The United States, however, shall be at liberty to maintain such military police along the canal as may be necessary to protect it against lawlessness and disorder."

Consider the conjunction of two great oceans by a constructed waterway.

It would not be difficult for an excitable writer to evoke sentiment on such a theme as this. It stirs one's faculties of thought, reflection, anticipation. Yes, it gives work for the imagination. As one contemplates the issues, how the useful aspects of its possibilities broaden out! How the opportunities and facilities of travel multiply! How much nearer seem to come the ancient lands of historic opulence and romance. More palpable to the mind's perspective is the apathy of those nations which, for ages, have been lolling in the lap of physical inertness. We can picture cities teeming with people, whose energies have become atrophied by the slothful languor of countless generations. Having no relations with the outside world, they cultivated so much land only as served their own needs.

But the era of rejuvenation seems to be dawning. Intercourse with the more active races of the west is causing a flutter of interest. Trade ambition is rousing the mentally indolent. Inertia is yielding to the stirring influence of the hustling sections of the human race. The people of the great China Empire, Japan, Korea, Siam, are recognising that the human mind is capable of something better than impassive acquiesence with the decrees of fate. The dark ages of exclusive isolation are rapidly vanishing. But, if the revivification of national life is to be more than a faint flutter, the functions of renewed life must be applied to live objects. They should be adjusted to the requirements of the new competitive era on which the resuscitated nations are entering. Once aroused from their lassitude, the desire to advance will also be aroused. They, too, will welcome the inauguration of shorter and speedier waterways to the vigorous communities of Europe and America.

The diminution of geographical distances.

The period of eager competition is the time of haste and bustle, In our own era of impetuous hurry, enormous sums of money are spent in shortening means and periods of intercourse. The pressing consideration is,—Who shall get there first? If there is a harvest of trade orders to be reaped, every commercial traveller is eager to be first in with reaping hook. Saving time on the journey is of moment. So is saving time in the transit of merchandise. In

commercial interchange speed is urgent, expeditiousness is insistent. The order of the day is, short cuts to the accomplishment of aims and aspirations for foremost place. So, if you can, even by a generous expenditure, shorten your journey, it will be less costly, less disappointing than going all your life by the roundabout way.

Think of the long voyage from London or New York to the littorals and slopes on the western side of the American continent; or by crossing the South Pacific Ocean, to China, Korea, Japan, the Philippines. Either transit must be made through the Straits of Magellan, or Cape Horn has to be rounded; the cold tempestuous weather of the storms from the Antarctic zone may have to be encountered. The canal will be in the tropics. From deep water in the Atlantic to deep water in the Pacific the distance will be $50\frac{1}{2}$ miles. For about 24 miles a steamer will pass through the Gatun Lake to Bas Obispo, where it will enter the Culebra Cut. This Cut extends for nine miles. It has been an enormously difficult job to complete the excavation.

Mr. Foster Fraser, in his book intituled, "Panama and What it Means," says:—"The canal will shorten the sea journey between New York and the west coast of the United States by over 8,000 miles. It is on the transit of merchant shipping that the canal must rely if it is to be a commercial success. In the matter of sea-borne goods, the manufacturers and merchants of the Eastern States (of America) will have an advantage of those thousands of miles over their present modes of transit in reaching California, Peru, parts of Chile, Australia and Japan. I do not see that Great Britain is likely to profit much, so far as concerns the Far East. The Suez Canal serves her turn. British Columbia should benefit, and possibly British trade with Peru and Mexico. America will be the chief gainer; should war ever break out between that country and China or Japan, the advantage of this diminished distance will be very great. Such an outbreak of hostilities cannot be deemed impossible. To perceive the peril we have but to note the exasperation caused in Japan by current exclusive legislation by the State of California.

Is it not both sane and safe to hold that if there is to be substantial mutual interest between West and East, there must not be churlish racial antagonism on either side. By reciprocal action they must get into touch with each other. One must serve the other in generous sentiment, in cordial commercial relations, in upright interchange of products. This involves communication on equitable terms. In these busy times speedy communication is the most profitable.

Then, there is for Australia a self-interested view to be taken of this short route from the Atlantic to the Pacific. Once on the Pacific Ocean the mariners of the maritime side of America might steam past San Francisco to Victoria, on Vancouver Island, then via Juan de Fuca to King George's Sound, and up that Sound to Vancouver city. By so doing, they might enter into competition with both England and Australia. So, in this connection, our American cousins will have the first chance in the profitable use of this new waterway. They are on the spot, they are in possession, they are finding the money to pay for the work, their engineers are superintending the construction. The activity and energy with which this great task has been pursued entitle them to some consideration on fair terms.

They have had terrible difficulties to contend with. The Isthmus of Panama, when this task was begun, was largely a miasmic swamp. It was a breeding ground for pestilent insects, which were inimical to human life. In the jungle the enemies of human life swarmed in myriads. Mosquitoes innumerable, were the carrying agents of deadly malarial germs, including those of yellow fever. This was the supreme obstacle. Healthy men might dig a track in volcanic soil, or delve a huge dyke through mountains of mixed volcanic material, which is dislodged and tumbled over by constant explosions of blasting material, but it was discouraging and disheartening when hundreds of workers, victims of insect bites, had to drop out of the ranks and sicken and die. Along the route of this utilitarian canal the evidences of death's ravages are dismally numerous. One observant traveller has written as follows :—"During the first year of the American occupation the death rate was two per hundred. . . It has been costing the United States £250,000 a year, and the constant employment of 1,500 men, to keep Panama free from the ravages of disease. . . The Americans have directed their main energies to preventive agencies, so that the men shall not fall sick. Yellow fever used to rage, horrible and sudden, and strong men quaked at the way their friends went down. In the cemetery at Colon there are more men lying dead from yellow fever than there are live men walking the streets. For the last few years there has not been an outbreak of yellow fever in the Isthmus."

All over Central America are evidences of evanished Spanish occupation. How the once vigorous power which, by military valour, or by missionary agency, spread itself over the countries in by-past centures has become effete, spiritless, powerless, does not come within the scope of this review. Numerous are the impressive relics of

Spanish national supremacy and religious conversion. The descendants of the Spaniards are listless, unenterprising ; no potency of impulse, no intensity of purpose, no force of application. The throbbing blood has become languid, the daring courage is enervated. When a nation is afflicted with mental ineptitude and physical inertness, its ancient reputation for bravery, energy, enterprise, will not save it from decadence ; it must then take a back place. In the tropics generally, among native races, the temperament is to dawdle away time.

The opening of this canal must affect British interests.

The completion and opening of this gigantic operation will revolutionise the conditions, the relations and the progress of the Republics of Central America. Capital for investment will flow thitherwards in a big stream. Now, the trade between Panama and San Francisco, on the north, and Valparaiso, on the south, employs only 200 vessels. In ten years hence it may easily be 2,000.

A pertinent question for us here to-night is, in what locality or sphere, in what form, and to what extent will the opening of this canal affect British interests ? Where will that event touch the economics of our Empire most speedily and most intimately ? The primary duty of modern Britons is to preserve intact those solid interests which, by military prowess or skilful diplomacy, it has taken ages to build up. Not avaricious expansion, but profitable consolidation, should be our aim. What has been honestly won for us we should retain. Where we have acquired rights of possession we should resist all efforts by sophistries of interpretation, or by tricks of legislation, to deprive us of those rights.

In relation to rights of territory and trade in connection with this canal, it will probably be in the Caribbean Sea that the British Empire will first feel the effect of a rush of traffic. The approach to the narrow neck of land which connects the two great divisions of the American continent is protected on the busiest side by a crescent of islands of varied sizes and degrees of fertility. Some belong to Britain, others to France. Not many years ago, the United States acquired from Spain, by force of arms, the important island of Cuba. The old maritime sea rovers—Spaniards, Danes, Dutch—have now little left. But Britain holds fast to Jamaica, Dominica, Trinidad, Grenada, Barbados, St. Vincent, the Bahama Group, and others ; known in the aggregate as the British West Indies. Then, on the mainland Great Britain has large commercial interests, and owns the territories known as British Honduras and British Guiana.

The islands named are mostly profuse in vegetation and production of foodstuffs. Their yield exceeds local requirements. Every year thousands of tons of sugar, cotton, coffee, tropical fruits, are exported to England. Last year, one large fruit company in America imported 26 million bunches of bananas alone. In the same year British imports from the West Indies amounted to £8,878,491, and exports to £8,331,474.

I refer to these insular portions of our Empire to show, firstly, their intrinsic value; secondly, their relation to the Isthmus of Panama. By their situation and commercial value they justify the claim of Great Britain that the terms of the Hay-Pauncefort Treaty should be carried out without prevarication or modification.

Now, the trade of the western side of Central and Southern America is mainly under British control. Britain has the steamers, America has not. I have read that it is difficult to find a single regular trading steamer "flying the United States flag, running between ports on the two sides of the Equator." On the South are Chile, Peru, Ecuador, Columbia, having a coastline of 3,475 miles. On the North are Nicaragua, Guatemala, Mexico; then come the American States of California, Oregon, Washington, with a coastline of about 2,800 miles. When the vessels of the United States can steam 2,000 miles more or less from New York, via the canal to Panama, these rich and populous States on the western side will seem very near to the 90 millions of Americans. British vessels must steam more than twice that distance.

But, by passing through the canal, British ships will vastly shorten their present voyages to the Republics and States just named. The present trade of Great Britain with the Republics to the South is great in minerals and metals; with the northern territories it is mostly in food stuffs. As a heavy freight route the canal will not be of much service to Great Britain. It will slightly shorten the journey from Britain to New Zealand. For tourists, a charming round the world voyage will be provided for persons who are not compelled by pressure of time to hurry. After touching at one or two of the British islands in the West Indies, the tourist may proceed by the canal to Mexico, with all its glories of natural scenery, its opulent resources of minerals, its noble architectural evidences of the missionary successes of the Roman Catholic Church in the era of Spanish dominancy. Follow up the coast to California, thence proceed by boat to the delightful scenery of Juan de Fuca; call for a day or two, or more, at Victoria, the capital of the Province of British Columbia; the seat of Government. It is situated at the south end of Vancouver

Island, and is truly the Paradise of the Pacific in that part of the world. A delightful ride for four hours on a steamer will take you to Vancouver city, on the mainland. Vancouver is one of the modern cities of accelerated growth not infrequent in the British Dominion of Canada. Twenty-five years ago it was mostly forest. It is a city largely surrounded with tranquil lakes, on the shores of which rise numerous snow-capped mountains. These white summits abide the whole year round.

After "doing" the sights of Vancouver, a steamer will bring the tourist in about three weeks to New Zealand, giving, on the route delightful views of busy and beautiful Honolulu, of Fiji, or Samoa, and many smaller islets of those groups. From New Zealand you steam, across to Sydney, where there is a large choice of mammoth boats, which will take you via Colombo, Port Said, Malta, or Gibraltar, to British ports. By leaving the steamer at a point on the Suez Canal, you may go by train to Cairo, and if time will permit, see the Nile, the great Assuan Dam, and the Egyptian Pyramids. With the exception of the Panama Canal, Mexico, California, and Honolulu, you would be always and everywhere under the safe protection of the British flag.

But this great project for connecting by an ample waterway two immense oceans, and diminishing distances in the matter of international commerce, may have an intimate bearing on international sentiment, friendship, and alliance. In the event of armed conflict between the United States and the far eastern countries, where the spirit of self-respect and self-interest has been aroused, and is being sedulously cultivated, the Panama Canal will open up an expeditious way for each belligerent to invade the other's territory, or at least for each to assail the other's most vulnerable points. The sensitiveness of the self-respect which has been aroused by intercourse with countries of more cultured intelligence and more civilised methods of government and trade, has been recently illustrated by the resentment caused in Japan by the refusal of California to allow any individual aliens to own property in that State.

In this connection, it is quite pertinent to refer to the cold reception given by nearly all the countries invited to the proposed great Exhibition at San Francisco, in 1915, to celebrate the opening of the canal. It is truly lamentable that any sophistical interpretation of a clause in a treaty, the meaning of which seems to be obvious, should be permitted to stir bad blood between two great and powerful sections of one race. I think that to a candid mind the meaning is obvious. But the population of the United States is very mixed.

It includes species that are prejudiced where the interests of Great Britain are concerned. International treaties embody solemn, perhaps critical, obligations. No amount of political or racial prejudice, nor of ingenious argument, can neutralise those obligations. It is gratifying to learn that President Wilson is believed to take a more impartial view than his predecessor of the meaning of that part of Article III., which says, that " the conditions or charges of traffic, while free and open to the vessels of commerce and war of all nations, shall be just and equitable."

America is beginning already to realise the value and influence of this undertaking. On the 24th of last month, a Press cable told us that the American fleet was to be divided into two units, the second one to be allocated to the Pacific Ocean, as that coast is now regarded as the great frontier of the United States, and its development and defence are a pressing duty of that nation. This confirms all that has been said in this room about the incomparable importance to America of this new maritime route.

The canal will shorten the distance between the east and west coasts of America from 13,000 miles to 5,000 miles. If the western slopes, on the Pacific coast were threatened by a hostile fleet from China or Japan, it would take a defensive fleet from New York or Colon about three months to get to the point of attack by the Cape Horn route.

California, with its frontage to the Pacific, and its accessibility to China or Japan, would be the vulnerable point. The great development of that State, its fertile resources, its comparative nearness to New Zealand and Australia, and its close and constant contact with the naval base of the United States at Honolulu, has made some swifter means of communication between San Francisco and the seat of government, and the important trading centres, a matter of vital urgency. There was only one way of getting it. The two great oceans must be conjoined by cutting through the Isthmus of Panama. The canal has been declared to be " a commercial convenience and a commercial necessity."

LONDON: THE IMPERIAL PORT AND MARKET OF THE WORLD.*

BY J. H. ESTILL, Superintendent for the Port of London Authority.

Although my mission to the Overseas Dominions is primarily to give you an idea of facilities existing in the Port of London for the handling of Australasian produce, and to draw your attention to the extensive alterations and improvements that are now being undertaken by the Port of London Authority, in order to provide for the future developments of your trade ; yet the trade of the Port is so extensive, and embraces such a variety of different businesses, that I hope to interest you this evening by a short illustrated description of some of the work carried on in the warehouses and docks of the Authority. However, with the time at my disposal it is only possible to give you a brief outline of the different subjects.

The magnitude of the trade of London, started in remote ages, and built up slowly but surely, is not always appreciated. Five hundred thousand persons are directly dependent upon the Port for a living, whilst nearly eight million Londoners, and as many millions of persons in the provinces, are directly dependent on its smooth working for the necessities and comforts of their daily lives. Go back as far as history records, and London has always been a place of primary importance. Writing of the Port as it was in A.D. 61, the Roman historian Tacitus tells us in his annals that "Londonium," as he calls it, was a place greatly famed for commerce and for the number of her merchants.

Until Elizabethan times, London, although always a place of importance, did not occupy the proud position of the premier port of the world. She was outshone by Antwerp. But in the reign of Elizabeth two incidents occurred which brought London to the fore.

Firstly, one Gresham built and presented to the City, a Bourse, which was opened by the Queen, and named The Royal Exchange.

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*Royal Geographical Society of Australasia, Queensland, December 11th, 1913.

The result of Gresham's munificence was all that could have been desired. London, now equipped with a financial clearing house, at which her merchants met daily to discuss and fix prices, thereby causing an expansion in trade, began to forge ahead of Antwerp.

Secondly, the religious wars in the Netherlands, culminating in the sacking of Antwerp by the Spaniards, brought immense losses to that city. Naturally enough, trade looked for another outlet, and found it in the Port of London. So well was it catered for here, that it has always remained, and from this time London took her place, and, in the face of all competitors, has kept it ever since—the proud place to which I have already referred—the position of premier port of the world.

The first wet dock was built in the reign of King Henry the eighth, or thereabouts. It was what we should now consider a primitive affair; but it was not until the end of the 18th or the dawn of the 19th century that the building of docks in London, was undertaken on a large scale. For centuries, trade was conducted in small ships, which needed no docks. Then, as I have remarked, in or about the year 1800, the building of docks on a large scale was taken in hand.

For about 100 years subsequent to the building of the docks, the affairs of the Port proceeded smoothly. But about the year 1900 it was manifest that the facilities in London were in danger of getting behind the times, and an agitation arose for improving the docks, and for a change in the management of those docks. A Royal Commission was appointed to enquire into the matter, and it reported in favour of the establishment of a new authority which should be responsible for the management of the river and the docks. The government of the day made two attempts, but failed to pass a Bill through Parliament on these lines. Then Mr. Lloyd George became President of the Board of Trade. He at once took the matter in hand with Sir Hudson Kearley, now Lord Devonport and Chairman of the Authority, and a Bill was introduced for the constitution of a new Authority, much on the lines recommended by the Royal Commission. There was considerable opposition by parties interested in the Bill, but eventually it received the Royal assent as the Port of London Act 1908, and a new Port Authority came into existence on March 31st, 1909.

By the Act there were transferred to the Authority the properties, powers, and obligations of the London and India, Surrey Commercial, and Millwall Dock Companies, the Thames Conservancy in respect to the river below Teddington Lock, and the Watermen's Company,

which had formerly been responsible for the registration of craft and of lightermen and watermen. The purchase price of all these undertakings was fixed by the Act at over £22,000,000.

The water area of the docks alone is 746 acres, whilst the entire estate extends to several thousand acres. There are upwards of 45 miles of quayage in the Port, and, quite apart from the hundreds of private warehouses, the Authority has warehousing accommodation for over 1,500,000 tons of goods.

The important position which the Port of London occupies in relation to foreign trade is indicated by the fact that the combined values of London's imports and exports for the year 1912 were £384,000,000, exceeding the aggregate of those of Hull, Bristol, Manchester, Southampton and Glasgow by £100,000,000.

The vessels which arrive at and depart from London, represent upwards of 39,000,000 net tons. You will better appreciate this figure when I mention that the ships cleared in and out of your magnificent harbour at Sydney—which is the finest natural harbour in the world, and the biggest European commercial centre east of Suez—have an aggregate tonnage of 8,000,000 tons.

About 60 per cent, of the shipping entering the Port discharges in the docks, the remainder at wharves or at moorings in the river. A large part of the cargo, not intended for immediate consumption, goes into the Authority's warehouses on the dock quays. This warehousing business is of great importance, comprising as it does, every class of merchandise entering the Port. The principal are grain, timber, wines and spirits, wool, frozen and chilled meat, sugar, tea, and tobacco.

For the year ended March 31st, 1913, the Port of London Authority landed or received, for warehousing or for immediate delivery, 2,366,796 tons of import goods. Nearly double this tonnage was also dealt with at private wharves in the river.

The stocks of imported goods in the warehouses of the Authority on March 31st, 1913, were no fewer than 431,303 tons—a striking figure when it is remembered that the modern tendency is for goods to go directly into consumption, and that the need of holding large stocks is far less pronounced than it used to be. These figures do not include the large private stocks and cargoes in the hands of shipowners.

It is often supposed by strangers who visit the docks that the produce stored in the warehouses is the property of the Authority. This is not the case. The Authority import absolutely nothing. They are, as a body, neither growers, producers, nor importers of

produce, but simply custodians, who perform such operations as the owners of the goods may direct. They house the produce discharged from the vessels; they report upon its weight, quality and condition to the merchants interested; they sort it to quality and to marks; they open packages containing such goods as are sold by inspection of the whole package, and they furnish samples which represent the exact condition of the produce. These samples are sent for exhibition to the London salerooms, where they are inspected by intending buyers.

In addition to the delivery and warehousing of import goods, the Authority also carry on a large business in the collection, conveyance and shipment of export goods.

As I have already pointed out, it is in connection with some of the interesting businesses warehoused and dealt with by the Authority, that I wish particularly to speak this evening.

We will commence our hasty tour of inspection at the Authority's Uptown warehouses.

One of the Port Authority's City warehouses, known as Commercial Road Warehouse, was specially designed for the accommodation of the traffic to and from the Tilbury Dock. At the depot, carts can deliver direct into railway trucks and receive direct from trucks alongside the railway platforms. Goods are conveyed direct from the railway truck to the warehouse by electric lifts. The total area of the warehouse is 358,000 square feet, approximately 8 acres.

In addition to being used for the accommodation of traffic landed at the Tilbury Dock, Commercial Road Warehouse is used for the storage of Indian and Ceylon teas.

We next come to Cutler Street Warehouse, another of the Port Authority's City Warehouses. It covers an area of 5 acres, holds 20,000 tons of goods, and has an average stock of merchandise worth £2,000,000. Thousands of tons of tea are stored here, besides carpets from Persia, cotton carpets from Bengal and Northern India, the well-known Turkey, and the brilliant coloured but not so durable Japs.

Porcelain from China and Japan is also stored here.

It is not an infrequent occurrence for Royalty to pay a visit to these warehouses. Just before I left, Queen Alexandra, the Dowager Empress of Russia, and Queen Amelia of Portugal, paid a lengthy visit to the docks and to the Town Warehouses of the Port Authority. Although the visit did not terminate until 7 p.m., their Majesties still wished to continue their tour of inspection.

Here are to be found oriental curios, comprising gods from the four corners of the earth; in fact, more gods are stored in this warehouse than it is generally supposed are worshipped. In addition, there are carved ivory figures, bronzes, lacquer cabinets, silk and satin screens beautifully embroidered, vases and bowls of beaten brass, Egyptian and Persian coffee pots and holders, Japanese pictures, and ancient manuscripts from Persia and Mexico. Also raw and waste silk, and silk and cotton piece goods from China, Japan and Bengal, the value of silk piece goods alone sometimes reaching £700,000.

One of the most important articles dealt with at Cutler Street Warehouse is ostrich feathers. The feathers are shown here for sale. There are six sales in the year. The average weight per sale is 130,000 lbs., and the value of the feathers annually sold about £3,000,000.

The feather sales conclude with the sales of the plumes of birds of paradise, osprey, coloured skins of parrots, pheasants from the Himalayas, humming-birds, jays, and numerous other kinds of fancy skins and feathers. Osprey plumes are imported from the Brazils, Venezuela, Burma, China, Japan, South India, Florida, South and West Africa, Turkey in Europe, and Southern Russia. The best of these feathers realise as much as £14 an ounce. The most valuable is the fibre-fine plume of the egret, which in some parts, especially South America, is reared on farms or enclosures under the protection of a sort of armed native police, the feathers being collected as they fall from the birds, during and after the breeding season.

The bulk of the cigars imported into London are stored at Cutler Street. There are more than one hundred million cigars stored in this warehouse, the estimated value of which, plus the Custom's duty, is about £600,000.

In addition to cigars, about 30,000,000 cigarettes, and about 210,000 lbs. of Cavendish tobacco in cases, are also warehoused here in the course of the year.

I have already mentioned the very large quantity of tea imported into London. The picture here shows the weighing of tea with a Custom's officer in attendance.

After tea has been bulked it has to be replaced in the original chests, and the picture shows men employed in treading the tea into the packages. Canvas sacks are placed over their boots, so as to prevent any dirt getting into the tea, and if the men do not put on the sack *they "get it."* Experiments have been tried with machinery fitted with hammers, which strike the sides of the chest,

so as to avoid the necessity of employing what appears to be a primitive method of repacking tea chests, but so far nothing has been found which is so effective as the human foot.

ST. KATHARINE DOCK.

The water area of this dock is only 10 acres. It is the smallest of all the docks in London, and is used by the smaller class of vessels, i.e., vessels up to 1,000 tons register. This does not sound very grand, but nevertheless, the dock serves a useful purpose as it is surrounded by fine ranges of warehouses, which contain China tea, indigo, bark, guttapercha, India rubber, wool and shells. The Apollinaris Water Company keep their store here, and there is a large warehouse in which the manufacturers of the West end of London make scent in bond. The reason for doing their work in the St. Katharine Dock is that the scent may be manufactured there without paying duty on the alcohol, so that in regard to scent which is re-exported, the manufacturer saves a considerable sum in duty which he could never recover. The scent of the flowers is brought from the south of France, and imprisoned in tallow. After the spirit has been extracted, the tallow is used in the manufacture of scented soap.

One of the warehouses at this dock is specially set apart for the storage and handling of Australian dried fruit. Being close to the city, the warehouse is very conveniently situated for brokers and dealers who may wish to inspect the goods.

Warehouses on the western side of the docks, as well as the extensive warehouses at Cutler Street and Commercial Road, views of which I have already shown you, are used by the Port Authority for the storage of tea, of which about 32,000 tons are housed and delivered annually.

Formerly, as is generally known, tea was imported almost entirely from China. Gradually, however, China tea has been displaced by the stronger teas of India and Ceylon, which now form about six-sevenths of the 188,000 tons annually imported into the Port of London. Tea will grow in all tropical and sub-tropical countries where the annual rainfall is over 60 inches. The chief element of expense in cultivation is labour, it being calculated that, roughly, one man produces a pound of tea a day. The area of production is, therefore, limited to those countries in which cheap labour is available.

Four large and well-lighted rooms are devoted to the use of shell importers. Here, large supplies of valuable shells, brought into the Thames from all parts of the world, are opened, weighed, sorted, and lotted for the public sales which are held six times in every year.

For supplies of mother-of-pearl, numerous countries are drawn upon. Some of the largest and best shells come from Manila and the Dutch East Indies, and others from Egypt, India, and the Straits Settlements. From £4 to £14 per cwt. is obtained for mother-of-pearl, and sometimes as much as £20. It is usually sorted on the floor—a work which requires special care to avoid breakages as the shells are dealt with. Green snail, Japan ear, bull mouth, spider, fancy cowries, murex, mother-of-pearl shells, trouchus, trumpets, helmets, and mussels—all these and more contribute their quota to the large supplies which come into the country for industrial and ornamental purposes, and are handled at the St. Katharine Dock, on behalf of the Port Authority, by a staff which possesses a unique experience of the shell trade.

At the sales of tortoise-shell, as many as five hundred lots are sometimes shown, arranged in three tiers round the windows.

The best tortoise-shell reaches London from the West Indies, and some of it fetches as much as £10 per lb. The average is 35s. per lb. Supplies of slightly less value come from the coast of East Africa, while some is also received from Western Australia and Fiji. An exhibition lot from Fiji recently sold for as much as £16 per lb. The article is becoming scarcer, and as the demand for it continues to increase, its value is steadily advancing. The tortoise-shell consists of thirteen plates, which overlap each other like tiles on a roof, and are thinned off at their adjoining edges. The thickness rarely exceeds an eighth of an inch. The shell possesses the property of being easily softened by heat equivalent to that of boiling water, and of retaining any form which is given to it while heated. In addition to its wide use in the making of toilet and ornamental articles, card cases, purses, and innumerable other requisites, tortoise-shell is largely employed for inlaying and ornamenting furniture. Some twenty-five or thirty tons a year represents the average quantity of this very expensive product which annually passes through the hands of the Port of London Authority. The better qualities, it may be noted, are incapable of successful imitation.

LONDON DOCK.

The London Dock is adjacent to the St. Katharine Dock, and has a water area of 40 acres. This dock also accommodates the smaller class of vessels, but the warehouses which are very substantially built, house some of the most valuable articles entering the Port of London. There is accommodation in the warehouses for about 220,000 tons of goods. Special premises are set apart for warehousing,

working, and showing wool, wine, brandy, sugar, rubber, gutta-percha, balata, dried and green fruits, ivory, spices, bark, metals, drugs, dates, pepper, rice, coffee, cocoa, gums, isinglass, quicksilver, and many other valuable goods.

The picture here shown is one of the Ivory floors. The bulk of the ivory comes from Africa—India, Ceylon, and other Asiatic countries producing little more than sufficient to supply local demands. A small quantity, brittle in quality, comes from Siberia under the name of fossil ivory, being tusks of extinct mammoth which have long been buried in the frozen soil of that region. The ivory of Africa is shipped from almost every port in that continent, and is superior in density and whiteness to any other description. It may here be said that many, perhaps most, of the tusks of elephants shown in this picture are not freshly killed beasts, but are the old treasure of African chiefs reluctantly surrendered, and stored, maybe for centuries, in remote African villages.

When received at the docks the ivory is weighed, examined, classified, and laid out for inspection. Special attention has to be directed to the detection of stones and metal, which are at times inserted by the natives in the hollow at the root of the tusk, in order to increase the weight. All this work is done by the Port Authority's staff, amongst whom are numbered several experts on ivory, whose opinions and unique knowledge of this trade stand unrivalled.

The tusks are often 9 feet in length, weighing 140 lbs. each, and the value, which is constantly increasing, is now from £70 to £110 per cwt.

The importations of ivory into London in 1912 were 5,688 cwt., of the value of £360,000, representing the ivory of about 34,000 elephants. The majority of these, however, died from natural causes, for it must not be supposed that a live elephant—though a somewhat cumbersome beast—is so useless that he is slaughtered merely for the value of his tusks.

Owing to the rapid growth of the rubber industry, the Port Authority have found it necessary to make considerable enlargement to their accommodation for dealing with this article. The picture now before us is one of the show floors, illustrating the method of displaying the samples of rubber for inspection by the merchants. Three capacious floors, each 250 feet in length, are devoted to showing this article. It is necessary to store the rubber in vaults underneath the show floors, in order that it may not lose in weight; this also preserves the uniformity of its colour, which is one of the points that buyers like to see.

The importations of rubber into London last year were 26,712 tons, the total value of which was about £12,000,000.

Balata, which is akin to India rubber, is also stored in considerable quantities in the vaults of this warehouse.

Before us now is a photograph of wool on show at the London Dock. In point of both tonnage and value, it is the most important article dealt with at the London Dock. Here you see buyers inspecting wool preparatory to bidding at the sales. About 700,000 bales pass through the warehouses in these docks every year, mostly from Australia and New Zealand.

Buyers attend the wool sales in London, which are held six times a year, from all over the world, and the keenest bidding is experienced. It is calculated that on an average run of years better prices are obtained in London than in any other market of the world.

The London Dock is famous for its wine vaults. The length of the gangway in the vaults is over 28 miles, and about 105,000 pipes of wine can be stowed at one time. The temperature in the vaults is about 60° Fahrenheit, and varies very little on the coldest day of winter or the hottest day in summer.

You will observe the ceilings of the wine vaults are covered with an extraordinary fungus, which is entirely absent in the brandy and rum vaults, whose ceilings are as clean as those of a Cathedral Crypt. If it is true that port wine kept in cask is not so gouty as that kept in bottle, the escape of this fungus through the wood no doubt accounts for it, but I cannot pretend to enlighten you on this point.

The vaults have been famous for 100 years, and although port, sherry, and madeira are not drunk so much as they were when the vaults were made, there are now more people to drink them.

A short distance from the wine vaults are the brandy vaults, 4 acres in extent.

A warehouse is practically set apart for the showing of gum. Several kinds of gum are imported, and the article is used for many purposes.

The principal are gum arabic, used for adhesive purposes ; gum kowrie and gum copal, used for making varnish ; gum benjamin, employed in perfumery, soap and court plaster ; gum kino, used for colouring purposes.

About 25,000 tons of gum are imported into London yearly ; of this amount Australia sends over 6,000 tons.

Quicksilver or mercury is also dealt with at the London Dock.

Quicksilver, though occasionally discovered pure in small quantities, is most frequently found in conjunction with silver in the ore named cinnabar. The ore is burned in a furnace, and the quicksilver is collected in condensing chambers, or is distilled with some substance capable of combining with sulphur, such as slaked lime or iron filings. Cinnabar has been worked at Almaden, in Spain, for the last 2,300 years, but the production of these mines is now surpassed by those of New Almaden, in California.

As received at the docks, the quicksilver is almost chemically pure, and is stored in iron bottles. It has peculiar properties. It is the only metal which is liquid at ordinary temperatures, yet, owing to its great density, heavy iron weights easily float on its surface. It boils at 662° Fahrenheit. Its regular expansion when heated, and contraction when cooled, make it the best agent for use in scientific instruments. Quicksilver is the basis of the pigment known as vermillion. It is, as is well known, used for silvering mirrors, and is most extensively employed in connection with the extraction of gold and silver from their respective ores.

SURREY COMMERCIAL DOCKS.

These docks are situated on the south side of the river Thames, and, including the ponds set apart for the floating of timber, have a total water area 167½ acres, with quayage of about six miles. They are the finest wood depots in the world, and are chiefly used by the Baltic and Canadian trades. Much of the grain entering the Port of London is housed here, but it is better known as a timber dock. Practically all the soft wood coming to London—timber such as pitch pine, deals, and other woods used for building purposes—is stored at these docks.

No milling is done at the docks, wood in these days being for the most part received from abroad already sawn to various lengths. When a cargo is landed on the quays, experienced men handle the timber and carry it away to various marks, qualities, and sizes. The work of piling is one demanding skill, which is only acquired after long practice, and the storage of log timber in ponds is a special feature of these docks, there being accommodation for 50,000 cubic loads of floated timber.

WEST INDIA DOCK.

Two of the principal commodities handled at this dock are hardwood and gum.

Hardwood, which includes the furniture timbers, such as mahogany, teak, oak, walnut, ebony, satinwood, and other expensive kinds, is stored at the West India Dock.

I recently visited the offices of the Agent-General for Victoria, and was struck by the beautiful desk which adorned his room, and which, he told me, was made of Australian fiddle wood. There is always a big demand in London for hardwood, which fetches good prices, and there is certainly a market for some of your beautifully marked Australian woods.

FURNITURE WOOD.

Judging from what I have seen since coming to Australia, I consider you have a natural asset in your timber, which if scientifically worked and marketed, would probably pay you better than some of the other articles you are striving to produce.

We spend millions yearly in buying furniture woods from other countries, and as an Imperialist, I would like to see some of that money coming to Australia.

The stock of rum warehoused at the rum department is about 2,200,000 gallons—enough to inebriate the whole population of the United Kingdom and Australasia if taken at one sitting.

MILLWALL DOCK.

This dock has a total area of 231½ acres, of which 36½ acres are water. Grain handling is a special feature of the Millwall Dock, and it is estimated that two-fifths of the grain coming into the Port of London is delivered into this dock.

The grain is discharged from the steamer to the warehouse by means of pneumatic tubes, by which it is sucked from the hold of the vessel, and deposited in the warehouse. The warehouse itself will hold about 24,000 tons of grain—sufficient to make 27,000,000 half quartern loaves. Yet this represents scarcely more than a week's need of the London district.

The grain discharging appliances at the Millwall Dock are capable of dealing with 500 tons of bulk grain per hour. In other words, the Authority's appliances at this dock alone are capable of discharging the whole of the colossal grain shipments sent from Australia and New Zealand—aggregating 600,000 tons per annum—in a period of six weeks continuous working.

ROYAL VICTORIA AND ALBERT DOCKS.

We now come to the largest dock system in London, namely, the Royal Victoria and Albert Docks. The system consists of two docks forming a continuous sheet of water *three* miles long, and 184 acres in extent. It is the largest sheet of dock water in the world, and the length of the quayage is nine miles.

When you are asked to pause and wonder at the quays of Antwerp, will you please bear in mind that the north side alone of the Royal Victoria and Albert Docks is equal in length to all the river quays of Antwerp.

The present view is in the Victoria Dock. This dock is devoted to large steamers, and also contains the warehouses in which is stored the whole of the tobacco that comes to London. There are to-day 21,000 tons of tobacco in these warehouses, the value of which, including duty, is about £11,000,000.

The chief frozen meat stores in the United Kingdom are situated here, and it is in this dock and at the Smithfield Market that the Authority are now spending upwards of £400,000 on extensions in connection with the frozen meat business. The capacity of the present cold stores on the dock quays is equal to 552,000 carcases.

Many representations have been made in regard to the handling of frozen meat, and the Authority, in order to meet the requirements of the trade, are erecting two double-storeyed sorting sheds each 500 feet in length. The ground floors will be used for general cargo, and the upper floors which will be insulated and kept at a temperature of 15° Fahrenheit, will be used for sorting and distributing refrigerated produce.

At the rear of and connected with the sorting sheds, a new insulated warehouse is being erected, capable of holding 250,000 carcases. As the sorting sheds will be insulated, they can, if necessary, be used as auxiliary cold stores. Their capacity will be 200,000 carcases.

The scheme is designed so that meat can be delivered from the vessel's hold by means of elevators, and conveyed through hatchways in the roof of the sorting shed, to continuous band transporters inside the shed, where it will be sorted to marks, and delivered mechanically to refrigerated railway trucks, road vans or other conveyances. If the meat is intended for storage with the Port Authority, it will be carried from the sorting sheds by means of covered band conveyors to the adjacent cold store, which will be maintained at a temperature of 15° Fahrenheit—the same as that obtaining in the sheds. The meat will be deposited in the chambers by means of mechanical lifts. There will be provision made at the store for dealing with deliveries of every description. Covered platforms will be provided round the store for delivery to railway vans and road vehicles.

The scheme is designated for extension, and can, if necessary, be continued the whole length of the quay, a distance of 6,000 feet.

In addition to this accommodation, the Authority are building another insulated warehouse at the West Smithfield Market, where they have already one insulated store with a capacity of nearly 100,000 carcases. The new warehouse will hold about 80,000 carcases. When these extensions are completed, the Port Authority will have a total storage capacity equivalent to 1,350,000 carcases. This will increase the total accommodation in the Port to 3,500,000 carcases.

The bulk of the Colonial trades are carried on at the Royal Victoria and Albert Docks ; and a new dock, costing about £2,000,000 is now under construction south of and parallel to the Royal Albert Dock, to provide for the future developments of the Colonial trades. It is expected that this new dock will be completed in about three years' time. The new sorting sheds and warehouse should be finished by the end of 1914.

DAIRY PRODUCE.

This picture shows the unloading of Australasian butter in London.

Before coming to Australia, I had heard a good deal about Australian butter, but have never to my knowledge tasted it. I would, therefore, take this opportunity of saying I have done a good deal of travelling, but have never before tasted such consistently excellent butter as you produce in the Commonwealth, and if you can get it on to the English market and sold as Australian butter, I feel sure there would be a great demand for it.

Your eggs and other produce I also consider excellent. We do want eggs in London, which lack the historical flavour—(Tale of Sheet Arab and fresh egg). We also want poultry. There is usually a dearth of poultry.

TILBURY DOCK.

At this dock are accommodated the Orient, Peninsular and Oriental, Atlantic Transport, and other important lines. It is the deepest dock in London, being 38 feet in depth, and having a water area of 90 acres.

A large quantity of Australian apples are handled here, being discharged by elevator in the ship's hold into sorting sheds, where they are sorted to marks, and conveyed direct to railway waggon for delivery to the London Market, or for direct delivery to provincial buyers.

ONE OF THE AUTHORITY'S ELECTRIC AMBULANCE WAGGONS.

The Authority have an excellent and well trained staff of men and provide all the equipment for dealing with accidents in the docks. They have a number of these motor electric ambulance waggons, and call boxes are placed in conspicuous places about the docks, so that, in the event of an accident, there may be as little delay as possible in rendering assistance.

CONCLUSION.

The Port of London Authority propose to spend £14,000,000 in modernising the Port, of which sum upwards of £5,000,000 is at present being spent on new dock extensions and improvements generally. Therefore, Australasia need have no fear that her business will not be well and efficiently catered for.

Although I have only touched very briefly on the ramifications of the Port of London Authority's dock business, yet I hope I have said sufficient to show you the magnitude of their undertaking and the immensity of London's trade.

It will, of course, be apparent that the millions of people interested in the various trades I have mentioned are centred in London, thus constituting an enormous local market which it is necessary to feed, and for which food we have to look to our great Overseas Dominions to supply.

Within a radius of 10 miles of the Royal Albert Dock, there is a population of nearly eight millions of people—almost double that of the whole of Australia.

Owing to the competition of the nine great railway trunk lines serving London, and to the frequent and regular sailings of steamers carrying goods at low rates to nearly all the coastwise ports of the United Kingdom and to the Continent, the facilities of London for the distribution of produce are unrivalled. It is factors such as these that cause London to be the magnetic pole of the world's commerce.

AN UNCONVENTIONAL VISIT TO SCENIC JAPAN AND HER PEOPLE—AND A FAIR INTERPRETATION OF BOTH.*

BY W. G. VIETH, Resident of Tokyo.

Before entering upon the subject of my lecture, I wish to premise that I cannot hope to add much to your knowledge in a scientific sense. Japan has so often been studied and reported on by competent men of science that she is no longer a terra incognita. The views set forth here are the result of many years experience, pure and simple, and an honest attempt on my behalf to picture land and life. They are not influenced or paid for by the Japanese Government or from any other side.

I may say, that I have, perhaps, gained a little more insight than the average hurried student of things Japanese, or even a resident who is tied down to his office chair or duty in one or the other of the large cities. In my travels I was frequently, for long periods, cut off from all outside communication, in the mountainous interior, or on some little out-of-the-way island, living the simple life of the people, wearing their dress, and eating their food. And I proclaim that no one can boast to possess a fair judgment of the Japanese unless he has really lived among them and acquired their language and customs to a certain extent. A mere study of books and newspaper reports will here utterly fail, and often lead to conclusions ridiculously erroneous.

It is only a short while ago that I have, for the first time, touched Australian soil. Finding that an unusual interest is taken here in all matters connected with the "Empire of the Rising Sun," and encouraged by some friends, I have now the honour of inviting you to accompany me on a short tour through that scenic country, and I shall try to explain sights and conditions as we go along.

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*Royal Geographical Society of Australasia, Queensland, June 17th, 1914.

A comfortable steamer of either the Eastern and Australian Steamship Co., Ltd., the German Lloyd, or the Nippon Yusen Kaisha, will convey us via ports to our destination. But we shall choose one that calls at Nagasaki ; be it that some of our party are glad to leave the rolling deep, and ditto vessel, behind, at the earliest opportunity offering,—or that we take a special interest in this the oldest Port of Entrance, where, as far back as the middle ages, western civilisation first gained a foothold.

It was in the year of 1542 that Mendez Pinto, a Portuguese navigator, discovered Japan, and disclosed to the world the existence of an Island Kingdom and people that held their own, possessing a unique civilisation, a civilisation which has in many ways continued to this very day. He landed at Oita, but, owing to its superior shipping facilities, Nagasaki soon became the first mart of foreign trade. Ever since it has been a favourite port, and its harbour is one of the prettiest in the Far East. A narrow inlet of about 3 miles in length, and not more than ¼ mile wide at the entrance, leads up to the town, affording anchorage for ships of all classes. It is indented with numerous bays, and surrounded by wooded hills.

Nagasaki is famous for its festivals in true Japanese style, and if we are so lucky as to call here about the middle of July, we may witness the bon matsuri, or feast of lanterns, when after dark, the hills surrounding the city are festooned with lanterns to welcome the spirits of the dead which are supposed to revisit then the scenes of their life on earth.

The Island of Kyushu, on which Nagasaki is situated, and where the Japanese nation first sprang up, is full of tradition dear to the Japanese mind, and almost every place of some size bears relation to history or mythology. Kumamoto with its old castle grounds, Kagoshima the seat of the powerful princes of Satsuma, Hakata where in the 13th century the fleet, sent by the Mongol leader Kublai Khan, to conquer Japan, was annihilated, I only mention. In modern warfare Sasebo has become of importance, which, however we shall not visit, the Naval Arsenal there being closed to the public. Our time will be far better invested by making an excursion to Unzen, a mountain resort noted for its hot sulphur springs, beautiful scenery and bracing air. It is situated at a height of about 2,500 feet, and frequented by residents of the China Ports.

But we cannot stay too long here, as there is still a vast journey before us. Now, previous to setting out on it, we take a look at the map in order to inform ourselves of the principal geographical features of the country we are travelling in.

The Japanese Empire reaches South as far as 21° 45′, the southernmost point of Formosa,—north to 50° 56′, the last of the Kurile Islands, opposite Kamschatka, N. Latitudes,—east to 156° 32′, the same island,—and west to 119° 18′, the Pescadores Islands, E. Longitudes. We are more especially interested in what is called Japan proper, and which consists of the mainland, Hondo, with adjacent Shikoku, and little Awaji, besides Kyushu, and a large number of smaller islands and groups surrounding these, among them Tsushima, near which the Russian fleet in 1905 met with its ill fate.

Hokkaido or Yesso, the southern half of Saghalin, the chain of the Kuriles, in the North, and Luchu and Bonin Islands, Formosa and Pescadores in the South, as well as Korea and part of Manchuria are Japanese possessions, more or less in a political sense only.

The country is mountainous almost throughout, but some rich plains are found around the large cities of Osaka, Tokyo, and Sendai. Owing to the narrow shape of all islands, rivers never attain to a great length, but are characteristic for their shallowness and wide stony beds.

The climate is very moist, and cannot be called healthy. It is hot in summer and cold in winter, especially along the West coast, which is exposed to the icy winds blowing from Siberia across the Japan Sea. The best time for a visit is from middle April to middle of June, and from the second half of October to the first half of January.

We shall now proceed with our journey, and take the railway to Moji, opposite Shimonoseki. Foreigners in Japan as a rule travel first-class ; the trains run on time, and the service is good. The Straits of Shimoneseki are now impregnably fortified, and here the far-famed Inland Sea commences, a lovely sheet of water studded with countless islands, which are often crowned by gnarled pine trees of fantastic shape. No visitor to Japan should miss the steamer ride across it, that we are now going to take. Our small coasting boat carries us to the most celebrated of all, Miyajima, which is sacred, and one of the "San Kei," or "Three Chief Sights" in native estimation, the other two being Amano Hashidate ("the bridge of Heaven") and Matsushima, which we shall visit later on.

You see here the chief Temple on the island. It is dedicated to three Shinto Goddesses. As is well known, Japan is full of temples, and let me explain right here, that there are two distinct types or religions respectively. Shinto is the aboriginal religion of the Japanese, favoured and enforced by the present Government. It is nature and ancestor worship combined, the chief Goddess being Amaterasu, the Goddess of the Sun, of whom the Emperor in person

claims direct descent. It is thus the most patriotic of all religions, explains much of the Japanese character, and has become a powerful cement indeed. Shinto does not teach a code of morals, its temples and shrines are mostly of a plain design, easily distinguished by one or several "torii," open gateways consisting of two vertical pillars, and one or two horizontal beams. These "torii" are constructed of stone, bronze or wood, the latter frequently painted red.

The other form of religion is Buddhism, which was introduced in the 6th century from Korea in its Chinese form. Although neglected if not suppressed now by the Government, it is still an important factor, especially with the peasantry and lower classes. Buddhism has doubtless done a great deal towards the development of that particular Japanese art which we so much admire, and from this point of view its decay is to be deplored. The temple buildings show often an elaborate architecture, splendid wood carvings in which the Japanese excel, and they are usually accompanied by fine Pagodas and bell towers.

The temple of Mijajima is viewed to best advantage at high tide, when it seems to float on the water, being partly built on posts. The deer you observe here are also considered sacred and are tame. On the other hand, dogs are not allowed, and another ancient rule forbade all births and deaths on the island.

We now resume our voyage, and after passing through the narrow river-like arm near Onomichi, with its strong tides and pleasing scenery, reach Kobe, the foremost shipping place for Japanese export, and finally Osaka, an emporium of industry and commerce, "the Manchester of the Far East."

Osaka has a population of over 1¼ million, but affords comparatively little in the way of sight-seeing, one exception being the Tennoji temple, a good specimen of Buddhistic architecture. The pagoda you see here stands in the grounds. From its height we enjoy a fine panorama, of the great city. The Kondo or "Golden Hall," this side of it, is highly decorated and dedicated to the Goddess Nyo-i-rin Kwannon.

There are other sights at Osaka, the mediæval castle with its stupendous walls and masonry, the Mint and a number of temples; but the dust and noise of the place do not appeal to us, so we take a train, or electric tram, to Kyoto, the ancient capital, and a real treasure haunt to the lover of Japanese art and curios.

And if we would spend a fortnight here we could not exhaust all that is to be seen in splendid old castles and temples, beautiful parks with their fish ponds and trained trees, fancy bridges and neat

garden houses. At any rate we will visit the Imperial Palace, having secured beforehand a permit from our Embassy, for it is closed to the general public. Its gateway is here before you, conveying a good impression of the exclusiveness and seriousness found within its walls. Here the Mikados dwelled in gilded captivity for centuries, while the whole country was ruled de facto from Eastern Japan by dictators and military usurpers, until 1869, when the late Emperor, Meiji, with the help of faithful adherents, was restored to the absolute power which had rightfully belonged to his ancestors.

Kyoto is divided by the river Kamogawa in two parts, and on a balmy summer evening it is very pleasant to sit on one of the numerous platforms that have been erected in the stony river bed, little bridges leading over from the tea-houses nearby. We watch the conservative Kyoto citizens eating and drinking, fanning themselves and listening to the music of singing girls. How fascinating all this life is to the adept of things Japanese. As by magic we feel retransposed into the happy middle ages when time was a matter of small concern. Here is a fair example of a Kyoto singing girl, wearing a fanciful kimono, and by the way, let me tell the ladies in our party that, among Japanese women of all classes fashion plays as important a part as among their western sisters. Of all places, Kyoto is leading in style, and nowhere else in Japan may we witness such a display of taste in design and richness of dress in the streets, preferably on high days and national holidays, when heavy silks, valuable brocade and embroidery are in evidence.

Fascinating as Kyoto is, we have to tear ourselves loose from its attractions. We are bound for the North, and, therefore, avail ourselves of the Tokaido Railway. This is a picturesque and the most travelled-over line in Japan, as it closely follows the ancient highway of same name, which connected the western with the eastern Capital, Kyoto and Tokyo. The road is nowadays little used, and decayed in parts, but we still observe now and then from the windows of our car some venerable black pines lining it that have withstood the strain and storms of ages.

Leaving Kyoto, we first follow the shores of Lake Biwa, whose beauties and great sights have been praised by many poets of whom Japan has produced an ample number, at all times. Then we plunge into a maze of hills and higher mountains. If we have a few days to spare, we may, at Ogaki, change cars and take a branch line to Yoro, and its fine waterfall, a favourite mountain resort in summer, where, so the proprietor of the crack yadoya or inn once assured me, the temperature in his particular rooms was 12 and 3/8 degrees lower

than the surrounding air, because his house was situated right close to the fall, and in that fact rested the real attraction of Yoro! You will understand from this that business instinct is as keen in Japan on exploiting nature as in western countries.

Returning to the main line, we soon reach Gifu, a provincial capital renowned for earthquakes and cormorant fishing, a more exciting than estethic procedure in which large birds are employed. Under the flare of torches they will dive at night from a boat into the crystal waters of the river, and after having filled their maw with small trout, be pulled on board by a string and forced to give up their catch into a basket. This method of fishing is not much practised in Japan, however.

Having passed through the prosperous provincial cities of Nagoya and Shizuoka, we obtain a glance of the picturesque pine-clad Peninsula of Mio-no-Matsubara. For a short time the railway skirts the sea-shore, until suddenly our eyes are delighted by the noble forms of Mt. Fuji towering to the left.

Fuji, called Fujisan by the Japanese, Fujiyama by foreigners, is sacred, and yearly visited by crowds of pilgrims, who consider its ascent a meritful act. It is the loftiest mountain of Japan proper, 12,390 feet above sea level, only a few cones in Formosa attaining to a greater height. The summit of Fuji is covered with snow all the year round, except during the hottest period of summer when the ascent is made. The latter involves no danger to an experienced climber, but is tiring and sometimes not without discomfort, as I found out in my second last ascent three years ago. With two companions I was confined in a small hut near the top for two days and nights in an intense cold, a taifun blowing then, making descent absolutely impossible. As is the case with many other high peaks, Fuji may be admired to far greater advantage from below, the virgin forest clothing its sides, and the pretty chain of lakes skirting its base add to the charm of the landscape.

In front of us and to the right of the line now, the mass of the Hakone Mountains looms up. They shelter some of the finest summer and health resorts in the country, so we alight at Gotemba Station, and hire saddle horses and coolie guides to take us over the stony pass to Lake and village Hakone. Those of us that are gifted with flexible joints—a very useful attribute in Japan—may avail themselves of an old style "Kago" or palanquin, which here, as at Nikko, is still in vogue, but a rather doubtful means of locomotion, as you may imagine from the picture. We are here on a section of the Tokaido, the ancient highway I have mentioned before.

Following the latter we next reach Miyanoshita, whose hotel Fujiya of world-wide renown and natural hot springs afford us a welcome rest. The manager, Mr. Yamaguchi, is very accommodating, and made friends with many foreign guests that have stayed at his house.

Leaving Miyanoshita, we take a motor car down the winding road and along a rushing mountain stream. At Kozu Station we catch the train which is to carry us to Yokohama, our next stopping place. This trip we may break to see the sights of Kamakura, above all the Daibutsu or Great Buddha, a bronze statue of nearly 50 feet in height. The scenic little island of Enoshima also is in this neighbourhood.

Yokohama is a chief port and figures first in import trade. Many foreign residents live here, most big steamers call, and good hotels are available. But altogether, there is not much to attract the tourist. The little Shinto shrine perched at the foot of a high cliff in the suburb of Hommoku is worth visiting, for the sake of the view over the bay obtained from here. Notice the red " torii " or gateway in front of it, and the old camphor tree to the left, a species of which now comparatively few trees remain.

A short walk further brings us to the representative landscape garden belonging to Mr. Hara, a wealthy gentleman, who has opened it to the public. The garden is particularly noted for its plum blossoms, and you can see between the garden house and the two pretty girls adorning the scene, some trunks and branches of old plum trees. As you all know, Japan is a land of flowers, and the plum blossom appears first of all, and fills the air with its fragrance in the depth of winter. The Japanese attach to this humble white flower the idea of womanly gentleness, while the bright, pink cherry blossom is, in their mind, representative of manly strength.

We leave Yokohama for the present, as we are bound for Tokyo, the modern capital, where the express train lands us at Shimbashi Station, after half an hour's ride. We are at once swallowed up by the busy life on Ginza Street, one of the finest thoroughfares of the great metropolis that shelters a population of approximately 2¼ millions, and covers an area of over 100 square miles. Hundreds of electric trams traverse all quarters, and electric light is in common use, which reminds us that Japan is blessed with cheap water power.

The best plan for us is to hire a motor car to see the chief places of interest, as they are of great distance from each other. First we go to Shiba Park, where we find a set of marvellous temples, mortuary shrines, built by the Tokugava Shoguns or Military Governors, who

actually ruled the country for 2½ centuries in profound peace. The first of this dynasty was Jeyasu, and I shall speak of him more later on. We behold here one of the principal gates of the temple grounds, richly ornamented and carved.

Next we have a glance at the Imperial Palace, from the outside, as it is strictly closed to the public, ever since Emperor Meiji, who died here 2 years ago, made it his residence in 1869.

The Castle grounds occupy the centre of the city, and are surrounded by strong walls and moats, the combination affording the prettiest bit of scenery in the capital, more so in early August, when the still water is covered with a mass of pink lotus flowers.

Now we take a long run to the suburb of Mukojima, a river bank, gay in April with cherry blossoms and thronged by crowds of holiday-makers. The sudden appearance of such a wealth of flowers seems to animate everybody and everything, and Sake, the national beverage, is much consumed. It is a regular merry carnival.

No doubt, the Japanese cherry flower is very pretty. The tender pink petals open out in a day, contrasting with the blackish colour of the bark, while no green is seen, which is perhaps the most remarkable feature.

Not far off from here lies Kameido, but we must go there in May, when the Wistarias are in bloom, and make it one of the first show places of the capital. The plants are trained over trellis surrounding a pond which contains carp and turtles. Dainty little girls will supply tea and refreshments to visitors, and specimens of the flower to take home. Here is my favourite occupied in picking some out.

On a Sunday we strike out to another show place, Asakusa Park, as it is then most lively. This is an Eldorado of the middle and lower classes, and a striking example of the strange mixture of amusement and religious belief which we meet with everywhere in Japan. The great temple of Kwannon here is an imposing edifice, and surrounding it we find street vendors stalls of all descriptions, cinema shows, theatres, an aquarium, a zoo, cheap photographers, and similar attractions to tempt the multitude, all to be enjoyed for a trifling sum.

The tower you see here stands nearby; it has 12 storeys, is 220 feet high, and affords a fine view over the city.

Another park much frequented is situated in the Ward of Ueno. Here we find the Hakubutsu Kwan, or Imperial Museum, a library, the Academy of Music, besides another set of Mortuary Shrines, or Mausolea, of which this Pagoda forms part.

Opposite the park stands the railway station for the North, and we directly buy a ticket there to pay a visit to Nikko, and the most renowned example of temple architecture in all Japan. After a six hours' journey over level country we arrive there, and take up quarters at the Kanaya or Nikko Hotel, both being conducted on western lines, and good.

We cross the stream on the so-called "Temporary Bridge," this side of the Sacred Red Bridge, which is closed to traffic, and was originally erected in 1638. The mighty Shoguns used to pass over it exclusively, when on a visit to the Mausolea of their ancestors beyond.

These are hidden in a magnificent grove of cedars. Words cannot describe the splendour and luxury of the Temples. Gold and colours, carvings and metal fastenings are profusely employed. The actual tombs on the other hand are very plain; within a stone balustrade we see a bronze monument in shape of a small pagoda. The one represented here is that of Jeyasu, the founder of Tokyo, whom I mentioned before. He was a great general, and altogether the greatest statesman that Japan has ever produced.

Further below two red lacquer buildings attract our attention. They are connected by a bridge, of less elaborate design than the rest, and dedicated to Buddhistic Deities. For the Tokugawa rulers favoured Buddhism in their day.

Most tourists return South after having done the other sights of the Nikko district. But they are too numerous to be all visited on our short trip. I only mention, therefore, the chief natural beauty spots. The Kegon Waterfall, Chuzenzi Lake, and Yumoto, with its hot springs, the latter noted for the wonderful display of tinted maple leaves in autumn.

North of Nikko there exists but one place worth the trouble of a long train journey. This is Matsushima, an archipelago of tiny islands, said to be 808 in number. They indeed form a wonderful and singular scene, consisting of white sandstone, frequently cut up by the restless waves into grotesque shape and clad with dark pines.

This practically finishes our tour through Scenic Japan, and we return to Yokohama, where we catch a steamer to take us back home. But before you leave the country, I wish to show you a few more scenes of characteristic Japanese life, as we meet it every day.

* * * *

And now a few more words on the Japanese as a Nation. Ever since the late Russian War they have been looked upon from all sides with suspicion. They have become proud and ambitious,

after their success, and we hardly can blame them. But, in my opinion, the fear of a Japanese invasion is not justified, neither is the word of a yellow peril. We have forced our western civilisation on a people that were quite satisfied in the possession of their own. The Japanese now find it difficult to live up to the occasion and keep pace. Naturally, for there is no doubt that Kankasian races are gifted with higher facilities. But, in order to exist and further develop at all, Japan *must* keep a powerful Army and a ready Navy. A wise Government tries to check emigration of its subjects to meet the wishes of white Nations.

But Japan is a poor country. Who will wonder that the small tradesman or the labourer, who works hard at home to earn his daily share of rice, longingly looks abroad.

The new Japan has to face far more serious difficulties than the old. Books and libraries have been written on the "Country of the Rising Sun," but the aforesaid bare facts only too often are overlooked. There is much truth and wisdom in a beautiful little poem by Edmund Vale, which at the conclusion of this lecture, I think, may be worth reciting.

ANNIVERSARY ADDRESS.*

BY JAMES STODART, M.L.A., President R.G.S.A.Q

Not the least exacting of the duties attaching to the position of President of a scientific and literary society, such as ours, is the preparation and delivery of an address at the end of his term of office. To a man of business, or to one whose activities are not exactly along our special lines of inquiry this duty is not at all an easy matter, nor is it rendered in the slightest degree easier by the knowledge that in these strenuous times the great majority of our members are similarly circumstanced, and few have the leisure or special knowledge to enable them to prepare something more worthy of the occasion. Happily for most men like myself, the scope of geographical science is so wide, so varied and so universal in its application that it appeals to the sympathies of all classes, entering largely into the industrial and intellectual life of the people, and associating itself with our domestic aims and social aspirations. Viewed in this light, it is merely in the exercise of duty that I have the honour of addressing you in a general way on one or two of the more homely aspects of the subject, in which we are all more or less interested. To those identified with the work of this society, it is gratifying to know that geography, the mother of all sciences, is yearly becoming of more recognised importance in all human affairs, entering largely into the life of the people ; above all, establishing itself as an essential element in the education of the youth, and proving itself to be indispensable in the art of statecraft. This has long been recognised by geographers of all ages from the time of Strabo down to the present day, and if convincing evidence be needed as to the trend of modern thought concerning the importance and universality of this vast subject, reference need only be made to an interesting speech (which I here quote at some length) at last year's annual dinner of our parent Society, London, by the Right Hon. Earl Curzon, of Kedleston, President, who said :—

*Royal Geographical Society of Australasia, Queensland, July 27th, 1914.

" I couple with this toast the name of the Secretary of State for Foreign Affairs, Sir Edward Grey. Perhaps the greatest compliment which has been paid within the last few years to the cause of geography has been the personality of the guests who have been willing to attend at our annual banquets at this table. Two years ago we were addressed by Lord Cromer and Lord Morley, certainly two of the most eminent and memorable Englishmen of their time. Last year we had as our chief guests, the Prime Minister, the Archbishop of Canterbury, and Mr. Rudyard Kipling, an illustrious trio whom it would be hard to beat. There were also silently present Lord Crewe and Lord Milner. To-night we have as our principal guest, the Foreign Secretary, whom we have drawn away, I believe not unwillingly, from that Conference table over which he is presiding with so much dignity and skill. We have also Lord Milner, whom you will hear presently, and Lord Grey.

" Why is it that all these eminent persons, so representative of many different branches of public life and activity, are willing to come here in honour of geography ? I do not feel inclined to ascribe it entirely to my own persuasiveness, although I am bound to say that, in my efforts to induce them to come, I have shrunk from no legitimate wile. I think rather that they come here to show their genuine interest in that science of which we of this Society are the accredited exponents and patrons. If I may use a metaphor—not I hope on this occasion a mixed metaphor—I would say that the shares of geography stand very high just now in the market of the world's appreciation. It is not merely that deeds of daring and heroism are still done by explorers and travellers, which make our blood tingle within our veins, and make us proud of the race from which we are sprung. It is not merely that in the popular enthusiasm for knowledge we welcome any extension of the boundaries of science. I think the encouragement of all these eminent men springs rather from the fact that the geographer's work is now being increasingly recognised as part of the indispensable work of the nation to which we belong, and of the Empire whose frontiers the geographer demarcates and sometimes accidentally extends—I put in " accidentally " in order to cover the retreat of the Secretary of State for Foreign Affairs. I say that geography is being increasingly recognised as the foundation science of the historian, the colonizer, the missionary, the trader, the administrator, and the statesman. Almost all of them have started from geography. If they neglect geography they make a mess of it. Geography is the basis of success in almost all these professions. Upon geographical data these

persons of whom I have spoken, build their knowledge of the past, they are enabled thereby to cope with the present, and they provide for the future. Further, the diffusion of geographical knowledge is one of the most potent agencies at work for the peace of mankind.

"Perhaps the most convincing proof that I can give you of the increasing triumph of geography is the influence which it now exercises upon our rulers. Take the House of Commons. When I was first elected to the House of Commons, I remember that a not undistinguished member of that assembly spoke of Warsaw as a seaport. I believe he afterwards excused himself on the ground that Shakespeare had ascribed a seacoast to Bohemia. But then, as we all know, literary people never have been geographers, with the possible exception of Milton, who would never have written "Paradise Lost" had he not studied his Hakluyt and Purchas. They are oblivious to the importance of latitudes and longitudes, and they resent the crude restrictions of maps. There is a famous writer still living, who, a short time ago, wrote a work appropriately of fiction, in which he described Bombay as being on the eastern shores of India; and the only way in which he could extricate the entire edition from compulsory destruction was by inserting a slip in each unsold copy to this effect,—'It must be understood that for the purpose of this book, and this book only, Bombay is on the shores of Bengal.' I am not going to let out his name. Our legislators have, perhaps, advanced somewhat beyond that stage, although they still are not very strong on their geographical legs, and their experiments in geographical pronunciation are sometimes enough to make one gasp."

. . . .

In the course of his reply, Sir Edward Grey said:—

"I gladly say that the study of geography has been of the highest value, and, if, as Lord Curzon said, the stocks of geography now stand high, I think it is because no doubt greatly through the instrumentality of this Society, the study of geography has been made more intelligible and more useful. As long as it was confined to a list of names of towns, and rivers, and mountains, with special attention to the particular height of the particular mountain, it did not seem to lead us very far; but when it began to embrace the study of climates, of the natural resources of different countries, of the characteristics and capacities of the population of those countries, and of the strategic advantages and disadvantages of different parts of the world, it became clear to all of us that it was one of the most valuable and essential studies to the Empire.

"Do not suppose that a very close study of these things at home has been necessary to the building up of an Empire. The British Empire, I think, has been built up in past generations without very close study of these things at home. But I am convinced that it is absolutely essential for the maintenance of an Empire, and especially of our Empire.

"But though we need a right perspective and a due sense of proportion in dealing with geographical matters, there is no doubt whatever that to-day more than ever—not to extend the Empire, but to retain the Empire—accurate, sound, thorough geographical knowledge, whether abroad or at home, is one of the essential foundations of success."

And if in the opinion of leading British statesmen, our success in the retention of the Empire so largely depends on the acquisition and extension of earth knowledge, it cannot surely be denied that our own local efforts in the cause of geography are not unworthy of wide public support. It is true we are but one of the outposts of the British Empire, and our acquired geographical knowledge has been mostly gained in pioneering enterprise, but we are making history and collating the crude material for the refining process of our more accomplished successors. This indeed is how the matter stands. For the last thirty years this Society has devoted its energies and its means to the promotion of a grand cause considered so essential to success in the extension of the Empire, and we look forward with some degree of confidence to the time when the geographical factor will be an indispensable qualification to a successful career at our local University. That this should not be so now is a regrettable blemish in our otherwise excellent educational system. Large sums of public money have been laid out in building up an elaborate and expensive fabric for the proper training of the youth of this great State, culminating in the University of Queensland, with its various schools and affiliated colleges, yet we find that geography, which is universally recognised as being "one of the essential foundations of success" in the retention of the Empire, and in the occupation and development of this country, is given but a subordinate position. With all the Universities of Europe, the position is vastly different, and even at the great conservative centres of Oxford and Cambridge, the importance of geographical knowledge has long been recognised in the chairs thereat dedicated to this qualifying subject. As a local excuse for indifference in this matter, it will probably be said that in the higher divisions of education the first stage has only been reached, and a beginning barely made; that the available means

are limited, and the time not yet ripe for further specialisation. But let it be remembered that no fabric can be considered durable and complete whose foundation is lacking in any of the elements of stability, whether breadth or depth, and if an edifice is to be built up in any way worthy of the great state of Queensland, suited to the industrial life of the people, calculated to develop and train to useful purpose the intellectual faculties of our citizens, then let it be done on broad principles, to include the great and important subject of geographical science, as being essential to success in the public affairs of the community, as well as in the retention of the Empire.

With these brief remarks, a few words may be said on the geographical events of the session. It may first of all be noted that the safe return of Dr. (now Sir Douglas) Mawson's Australian Expedition from the Antarctic ice-fields has aroused world-wide interest, and once more turned public attention to the dangers and privations associated with exploratory enterprise in the South Polar regions. That the scientific results of this national undertaking will be of far-reaching importance, adding greatly to our knowledge of the geographical conditions of Antarctica, we already have evidence in the published accounts of the expedition, as furnished by the leader, and we may rest assured that the contributions to biological science, to oceanography, to geology, and to meteorology, will be of no less value.

In the earlier life of this Society, reference was made by some of my predecessors to the probable influence exercised by the conditions and movements of the South Polar ice masses on the Australian climate and rainfall. The character of the ice-fields has since then been under careful observation by British and Foreign explorers from time to time during a number of years, and while the subject may as yet be said to be still in the speculative stage, the evidence seems to point to the conclusion that to better understand our local climatic changes, the occurrence of rainfall, and the fluctuations of temperature, it will be necessary to have communication with properly equipped meteorological stations on the Antarctic continent, or the islands adjacent thereto; that the distribution of ice masses will have to be considered, and our weather system greatly extended. That the subject is one of great importance to the industrial life of Australia there can, it is submitted, be no reasonable doubt, and every movement in the direction of South Polar exploration in the interests of science should be encouraged by the public in every way possible. In this respect, it is hoped that the approaching

visit of members of the British Association to the shores of Australia will awaken fresh interest in the matter of Antarctic enterprise and research. Some such stimulating movement in the world of human knowledge is greatly needed, especially in a young country where there is no leisured and moneyed class of people, and competition among all sections of the community being so keen, there is really little time to devote to intellectual exercises or the more interesting occupation of exploration and discovery.

Turning now to our own domestic activities, and more especially to the work of last session brought to a close at this meeting, some slight reference may be made to the subjects with which we have had to deal in the shape of papers or addresses during that time. In an illustrated discourse on "Glimpses of Canada, including the Niagara Falls," our worthy Councillor, Mr. W. R. Parker, gave an interesting description of Canadian life and scenery, showing the remarkable progress made in settling that great country during recent times. Following upon this, we were favoured by the Rev. Father O'Flynn, with a picturesque lecture on a tour which he made through Europe and America, the account being given in a most forceful and eloquent manner to a large and appreciative audience of the members and their friends. At the following meeting, at which his Excellency the Governor presided, our Honorary Secretary and Treasurer, Dr. J. P. Thomson, spoke on the subject of "Halley's Comet and Associated Celestial Phenomena," his remarks being illustrated by a large collection of lantern slide pictures of great interest and beauty. Before the usual midsummer recess, we had the pleasure of hearing a paper of wide interest and importance on "London: The Imperial Port and Market of the World," by Mr. J. H. Estill, Superintendent for the Port of London Authority, who illustrated the subject by a very fine set of lantern slides. This was succeeded by our old friend, the Hon. F. T. Brentnall's discourse on "Some Beauty Spots of New South Wales," in which vivid descriptions were given of cave and mountain scenery, beautifully illustrated by a splendid set of lantern slides kindly loaned to the lecturer by the Government of New South Wales. We were next privileged to have an illustrated discourse from Mr. C. W. Costin, on "Picturesque New Zealand," in which an informative account was given of the land of the Moa, and its autochthonous inhabitants, there being thrown on the screen a beautiful series of pictures, which lent additional interest to the subject. At the last monthly meeting of the Session, we had an address by Mr. W. G. Vieth, of Tokyo, on "An Unconventional Visit to Scenic Japan and Her People, and a

Fair Interpretation of Both." This, too, was very fully illustrated by a splendid selection of lantern slide pictures, which helped greatly to elucidate the subject, and contributed materially to the success of the lecture. It will thus be seen that the sessional programme covers a fairly wide representative field of work, in which a considerable variety of subjects are included, each one being illustrated by some appropriate pictorial representation. And last of all, we are to be favoured on this occasion by our active member, Mr. J. J. Cummins, with a paper on the Daly River, Northern Territory, which can hardly fail to interest many of our supporters both in town and country, dealing as it does with a little known part of Australia concerning which our geographical knowledge is very imperfect. It is, however, under Federal control, having been taken over by the Commonwealth Government some time ago, and presents an important racial problem as to its settlement and further development. With a sessional programme of this nature, it can hardly be said that the Society has failed to cater for the city and suburban members who have assisted so largely in the success of our monthly meetings. A wider variety of subjects could hardly have been provided, and it is hoped that the ensuing session will be equally, if not more, successful. In conclusion, it only remains for me to thank you all for the support which you have given during my term of office. Furthermore, I desire to thank the members of the Council for their valuable assistance during the year, and also at the same time to recognise the energy and assiduous attention of our Hon. Secretary and Treasurer to our business, which have enabled me to steer the Society on a proper course, making duty as your President one of great pleasure, and lightening the burden of office considerably.

THE DALY RIVER—NORTHERN TERRITORY.*

BY J. J. CUMMINS, Authorised Surveyor.

On the 1st January, 1911, the great land, formerly known as the Northern Territory of South Australia, became the heritage of the people of the Commonwealth of Australia. At the outset, whilst admitting the great wisdom and necessity of this action by the Commonwealth, let us not lightly pass by the great work done by the State of South Australia for this Territory. South Australia took over the Territory in 1863, but it must be distinctly understood that the Letters Patent did not incorporate the Northern Territory with South Australia. It is stated in several places in these Letters Patent, " that so far as the whole or any part of the Territory the annexation was temporary, tentative and terminable at the pleasure of the Crown." In 1882, the South Australian Government asked the Imperial Government to grant permanent possession of the Northern Territory as an integral part of South Australia, but this request was refused (1883).

From these we see what a large burden South Australia took upon its young shoulders, for here we had a young struggling colony, with an area of 380,070 square miles, and a population of 1,931 Europeans and 1,528 coloured races, endeavouring, even at this embryo stage, to nurse an infant and practically unknown territory with an area of 523,620 square miles. In addition, the distance from the seat of Government (in Adelaide) to Darwin, was about 4,000 miles by sea, or half-way round the continent. Sea distances as follows :—

Adelaide to Melbourne	500	miles
Melbourne to Sydney	570	,,
Sydney to Brisbane	500	,,
Brisbane to Cooktown	1100	,,
Cooktown to Thursday Is. ..	600	,,
Thursday Is. to Darwin	730	,,
Total	4000	,,

*Royal Geographical Society of Australasia, Queensland, July 27th, 1914.

When we consider that this large territory, greater in area than any two countries in Europe (Russia excepted), and larger than the United Kingdom, France and Germany taken together, has been fostered by our Sister State for nearly 50 years, we begin to comprehend the herculean nature of the task of its colonisation and development. At a casual glance little seems to have been done, but the construction of the Overland Telegraph alone is a grand monument to the enterprise of South Australia. This was our first link with London, and was completed on 22nd August, 1872, ten years after the first crossing of the continent by McDowall Stuart (July, 1862). It is stated, even in official books, that the telegraph line is constructed on the route of that intrepid explorer, but as he stood on the shores of the sea about 100 miles East of Darwin, where even now the remains of the tree marked by him may be seen, and the terminal point of the telegraph line is Darwin, one can see that this statement is not strictly true.

The other great work done was the Darwin to Pine Creek Railway, which was opened for traffic in 1889, at a cost of £1,180,263, or £8,116 per mile.

Amongst the minor Public Works are the numerous public buildings in Darwin and the Government jetty, making in all an expenditure of nearly three millions. The population of the Territory in 1911 was 1,730 whites and 1,442 Asiatic.

These facts show briefly the position of affairs when the Territory was handed over to Australia, and serves to indicate what a great national work we have undertaken.

The Territory being such a large country, extending from North to South over 15 degrees of Latitude (from 11° S. Latitude to 26° S. Latitude), and from East to West extending over 9 degrees of Longitude, viz., 129° E. Long. to 138° E. Long., any general statement regarding the climate, or character of country, would only be applicable to a certain limited area. This accounts for the conflicting opinions of various travellers.

The first view that a person travelling from the Eastern States gets of the Northern Territory is a long, low, wooded coastline. These are Wessel's Islands, on the western shores of the Gulf of Carpentaria. No other land is sighted until another day's steaming, when one passes Raffles Bay and Port Essington, on Coburg Peninsula. These two places were the site of the old military settlement of the British Government, under Captain Stirling. They had moved from Fort Dundas in 1827 to Raffles Bay, and thence from Raffles Bay to Victoria on Port Essington. This latter settlement was abandoned in the year 1849, and the soldiers sent to India.

After leaving this point, the steamer turns South, and enters Dundas Strait. This Strait, between Coburg Peninsula and Melville Island, is about 15 miles wide ; continuing in a south-westerly direction, one passes through Clarence Strait, between the Vernon Island and Melville Island. This is a narrow channel, and requires careful navigation. Four hours steam, and the vessel enters Darwin Harbour. This harbour was discovered by Captain Wickham in 1839. The town of Palmerston (now called Darwin), was laid out in 1869, by W. E. Goyder, the Surveyor-General of South Australia. A previous settlement had been formed at Escape Cliffs, some 40 miles easterly along the coast, but was not a success. The harbour of Darwin is one of the finest in Australia. It is well sheltered, and has deep water. There is a mean tide of 21 feet, and the largest ships can berth at the jetty. Its importance as a port can hardly be over-estimated. The town is built on the east side of the harbour, and commands a fine view of it. It is a place of great natural beauty, and the sight of the high, bold cliffs, and the town nestling amongst the dark, green trees, is one long to be remembered. The population is about 600, fully half of which is coloured, mainly Chinese. The Chinese, as is generally the case, occupy a quarter apart from the European. This quarter is as squalid and insanitary as any Eastern town, though to redeem it somewhat, the street in Chinatown is two chains wide. The European quarter has some fine public buildings. The Residency which overlooks the harbour, the Land and Court Offices, adjacent thereto the Palmerston Institute, the two Banks, and the Hotel Victoria, are very imposing structures. They are built of stone. This stone is found near Darwin. It is very soft to work, but gets very hard after being exposed to the air. The other buildings in the town are constructed of galvanised iron, with angle-iron frames. The verandahs are enclosed with bamboo laths. Owing to the white ants, nearly all floors are made of concrete.

Owing to the large itinerant population of Darwin, the hotel accommodation has been, for the past two years, taxed to the utmost, and, unless specially engaged, rooms are not procurable at all. Darwin is at present the entrepot for all Territory traffic. With the exception of the overland cattle traffic, via Anthony's Lagoon into Queensland, all people enter or leave the Territory via Darwin. From Darwin to the Daly River there are two routes, one by sea, the other overland by rail to Brock's Creek, 104 miles, and thence across country westerly for 70 miles. The sea route is 90 miles to the mouth of the river, thence 50 miles up the river to the landing.

The present service to the Daly River by water is per lugger, and unless one is a good sailor, and prepared for the maximum of discomfort, it is much preferable to journey by land. The luggers have no convenience for passengers. They occupy from 4 to 7 days on the trip, according to the weather. They are mostly manned by Malays. They are from 30 to 35 feet overall, and are decked in. They sail at the rate of 4 to 5 miles per hour with a favourable breeze. They are usually yawl rigged, with two masts, and carry two small mainsails and a jib sail. The Government are now installing a steam launch service, which will be a great boon to sea-coast travellers.

Going overland one gets into the train at Darwin, and the railway journey to Brock's Creek occupies six hours. This is a remarkably fast time for such a journey. The rolling stock is as obsolete as can be imagined. The engine is of very light type indeed, being in strange contrast to our modern locomotives. The gauge is similar to our Queensland one, 3ft. 6in. The line is in good running order, and, as there are no curves less than eight chain radius, and no gradient in excess of 1 in 65, this accounts for the comparatively high speed attained with such old locomotives. The scenery along the railway line is of a uniform character. In fact, one is immediately struck with the non-tropical nature of the vegetation. Stunted gum and stringy bark forests are everywhere seen, and were it not for an occasional pandanus, one could easily imagine one's self in Southern Queensland or New South Wales. Only when crossing a river or creek is this forest country relieved by a narrow patch of jungle undergrowth.

The first 80 miles of the journey is over very level country. As the train leaves at 8 o'clock in the morning, after the 80 miles has been travelled, a long stop is made for lunch. The passengers have to buy the lunch or other refreshments they may require before they leave Darwin, and even at Adelaide River, where this stop is made, there is no tea available, but one can buy hot water for 6d. per quart. From Adelaide River to Brock's Creek, the country is more hilly,—low sandstone and granite ridges, covered with stunted stringy bark and gum are seen ; whilst they are very alluring to the eye of the prospector, they offer no encouragement to the agriculturist. Brock's Creek is reached about 2 o'clock, and one is very glad that this part of the journey is over.

The remarkable feature about this railway is the economy exercised in running it. There are no station masters or porters, except at Darwin and Pine Creek terminus. The guard acts as ticket collector,

shunter and general agent, in fact he is all the officials from one end to the other. His duties are legion, and the commissions he has to undertake on behalf of the community along the line cover a wide range. In strong contrast to this economy are the exorbitant fares and freights. I would say without hesitation that it is the dearest railway travelling in the world. Even at present, and the fares and freights have been considerably reduced since 1912, it is 25 per cent. advance on the highest rates elsewhere in Australia, and the comfort and convenience are 25 per cent. less than prevail elsewhere in Australia. This question of exorbitant tariffs both to Darwin per steamer and in the Territory per rail or boat, is a very serious drawback to people going there. From Brisbane to Darwin —8 days' journey direct, or 10 days with stoppages—the first saloon fare is £18 single, and £12 second class. This is almost equivalent to asking people not to come to the Territory.

But to return to Brock's Creek. This is a small mining settlement, a mere remnant of former greatness. Twenty years ago there was a population of 3,000 Chinese and several hundred whites; to-day there are 20 or 30 Chinese and half a dozen whites. Everywhere the ground is rooted up, and one has to be very careful not to fall into the numerous holes. Several neglected batteries are rusting away, and the mournful tale of the past greatness, which is told to all newcomers, is the only thing of interest. We hired horses and vehicles from the host of the only hotel, and provisioned ourselves for the 70 miles stage overland to our destination. The trip occupies from 3 to 4 days, for although the road is level, the horses have to be taken very steadily. Horses which have been travelled too fast on the coast country get a disease called the "Puffs," and are of very little use again, except in the cooler weather. The country from Brock's Creek to the Daly River is very well watered. From November to April the country is too boggy to travel, but from May to October it is a very pleasant trip. Towards the end of October the creeks are very dry, and there are 20 mile stages without water. But when one arrives at the Daly River it is worth while. We struck it at the old copper landing about 50 miles from the mouth. Here the river is some 100 to 110 yards wide. This point is about 10 miles below the extreme limit of the tide. There are two tides a day. The spring tide rises to a height of 4ft. 7in., and the neap tide 2ft. 6in. This river is one of the great rivers of Australia. It drains an area of 14,000 square miles, though the extreme length of the river is only 300 miles. Though it is not a long river, still it is a very large one. The main tributary is the Katharine River, which rises in a high

tableland 40 miles north-east of the Katherine Telegraph Station. Four other rivers join in and form the Daly, namely, the King, the Flora, the Edith, and the Ferguson. As all these rivers rise in country with a rainfall of from 40 to 50 inches per annum, one is not surprised at the amount of water carried down by the river. Though no rain falls from April until November, and there are two tides per diem, which run up about 75 miles, so great is the amount of fresh water coming down the stream, that one can get perfectly fresh water at all times right within 25 miles from the river's mouth. The river may be divided into three sections:—(1st) The head waters of all the rivers forming the Daly on the upland plains at the head of the Katharine and Flora Rivers, and extending to the junction of the Ferguson; (2nd) The middle section of the river which runs through high stony ridges. This section extends to the tidal portion of the river; (3rd) The tidal portion of the river extending from the bar, where the river emerges from the stony ridges to the river mouth, a distance of about 75 miles. It is with this last part that we are dealing.

The first section comprises granite country, and is rich in mineral. The second section, which is practically unexplored, runs through high granite ranges. In places the river runs in a deep canon. About twenty miles above the tidal limit the river opens out into a swamp. Below this swamp there are small lagoons containing quite warm water. We bathed in them and found it very refreshing, though owing to the warmth one cannot linger too long in the water. There are some fine high tablelands in this section, and occasional forests of cypress pine. The scenery is very impressive, and there are good mineral indications. The third (tidal) section, as before stated, is about 75 miles in length. Ten miles below the limit of tide the river emerges into the plains, which thus extend from its mouth for 60 miles. This section of the river has a rainfall of about 60 inches. I kept a record during the wet season that I remained here. (Appended herewith).

The banks of the river, which are from 30 to 36 feet above high water mark, are clothed in vegetation, and the view when travelling along in a boat is one of great beauty. There is the drab green of the tea-tree, relieving the darker green of the jungle, and this is relieved now and again by a short strip of bank bare of any vegetation. The river is 160 yards wide at a point 60 miles up, and it gradually widens out; about 20 miles from the mouth it is nearly ½ mile wide. At intervals along the river short tidal creeks run in which drain the adjoining swamps. They may be seen winding across the flats as

their banks are lined with dense jungle. At the mouth of most of these creeks there are camps of natives, and their canoes are to be met with right along the river.

There are usually two tides in every 26 hours on the river, though occasionally there is only one tide per day. This is one of the few rivers in Australia where there is a tidal bore. During the spring tides the advancing tide is heralded by a loud roar like thunder, which at night time can be heard for miles. The incoming tide rushes in with the water heaped up like a wall from three to four feet high, and travels from 5 to 6 miles per hour. This bore leaves a tidal wave in its wake, and woe betide the unwary boatman who is not on the alert, and who has anchored his boat with too tight a chain. The bore causes the tide to rise to a height of two feet immediately it has passed. The bore goes up about 55 miles. It is due to the funnel-shaped entrance of the river. The maximum height of the tide 50 miles up is 4ft. 8½ins., and the neap tide rises to a height of 2ft. 8ins. At the mouth, the tide rises to a maximum height of 10 feet. The waters of the river are usually very clear, though the bore stirs up the mud very considerably.

From April to November, which is the dry season, the river runs placidly along, and gets lower at the rate of about 6 inches per month. From December to March (during the wet season) the river is usually in high flood. If the rains are early the river rises in December, and remains at 24 to 26 feet high for 3 or 4 weeks at a stretch. If the rains are late the river rises in February or March. The wide flats which extend on either side of the river are overflowed during these floods.

To get an idea of the character of the country, and also to see a wonderful panoramic view, one has to climb Mt. Hayward. This is a mountain about 55 miles up the river, and distant about 30 miles in air line. From it one can see the Daly winding about through the plain, its course plainly marked by the thick fringe of jungle on either bank, and where the banks are open a glimpse of shining water is seen. The view of this great river, with its alternation of forest flats, open plains and huge lagoons, is a magnificent one. In flood time, how different, and perhaps how much more wonderful, is the panorama. The great plains are a huge inland sea, dotted with hundreds of green islands. The whole of the plain, except for an occasional high ironstone ridge, is right under water.

Some idea of the size of this plain may be gathered when it stretches for a width of from five to fifteen miles (gradually increasing in width in the lower reaches) on either side of the river, right from

Mt. Hayward. This gives an area of nearly 400,000 acres, of which about 200,000 is good agricultural land, with this great river draining and fertilising it. The balance of the plain is covered with huge swampy lagoons which are full of water during the wet season, but are nearly dry during the dry season, and should the wet season be late they are quite dry.

Behind these plains the hinterland is also good available country, suitable for pastoral purposes.

The soil on the plains is a light black, with intrusive belts of red sandy loam. The Government Demonstration Farm, which is situated 50 miles up the river, has grown some splendid crops.

Here is this area of magnificent agricultural country, only 150 miles from Darwin by sea, and 70 miles from Brock's Creek. One immediately is asked why is it not made available, but the present drawback is the regular recurrence of the floods. The highest land, except the low ironstone ridges, is right along the banks of the river. It is from $\frac{1}{4}$ mile to a mile in width. This high land gradually slopes off and runs into swampy lagoons. In the wet season the lagoons fill and gradually encroach on the high land, until (if the flood is exceptionally heavy), the river overflows its banks, and forms a huge sea, and as the river, owing to its tremendous watershed, may remain high for a considerable time, this makes it very inconvenient, especially if one has only a small area of land. As a rule, the river does not overflow its banks in the higher places.

There is no danger of currents, as the water gradually subsides and runs off per medium of the small feeder creeks of the lagoons. The second consideration is that one has to crop the land during the wet, and this is a difficult matter as the ground is difficult even to walk over, being very boggy. The possibilities of irrigation are second to no place in the world, for there are some deep permanent billabongs parallel to the river, and about a mile to 2 miles distant.

The flora of this district is very disappointing, and after the magnificent flora of Queensland it is very meagre indeed. With the exception of the tea-trees, very few of the trees exceed two feet in diameter. The vegetation is more temperate than tropical. The main timbers are blue gum (two varieties), swamp oak, bloodwood plum, ironwood, and tea-tree. They are all similar varieties to those found in the South, but very stunted. I attribute some of this stunted growth to the ravages of the white ant. The ironwood is a very hard wood, but the tree does not attain a commercial size, being rarely more than 18 inches in diameter, and has a very short barrel. The tea-tree, which is looked upon as the most useful timber tree up

here, nowhere attains the height or size that it does in the swamps of Southern Queensland. It is commonly known as "paper bark." The only foreign note in the forest here is the pandanus, which appears amongst the forest. The jungle, whilst it is very dense, has none of the large trees that are found in the scrubs of Southern Queensland. The banyan is the only very large tree found. The kapock grows to about 3 feet in diameter. The natives use the wood for their canoes, and collect the kapock, which they use for ornamenting their bodies. This is a deciduous tree. The only useful timber found in the jungle is the Leichhardt pine, but it is a very big specimen that is 30 inches in diameter. Another useful tree found in the jungle is that known to the blacks as "Moya." It is a species of scrub wattle, and is very durable. In the jungle there is an entire absence of those parasitical ferns that are so numerous in our own scrubs. Along the foreshores of the river and tidal creeks, and also scattered through the jungle, dense groves of bamboos are found. I do not consider these indigenous, but have been introduced by the Malays, who have been trading with the natives for centuries. The Tamarind is another tree introduced by the Malays. Neither it nor the bamboo are found far away from tidal rivers. In the jungles Yams are very plentiful. There are two species, a small white yam like a young sweet potato, and a large round one similar to a big turnip. The large one has a very acrid flavour. On the swamps numerous lilies flourish, and when in bloom are a very fine sight. The grasses are very rank, and grow to a great height. It is of a cane variety, and very nutritious when young. About 3 months after the rain, i.e., in May or June, it reaches a height of 10 or 12 feet. I have seen it as high as 19 feet. It is then impossible to get about the country except on the blackfellows' pads. It is burnt by the natives about this time, and does not grow very high again, until after the following wet. Here and there patches of couch grass are found. Horehound and sida retusa are evidences of civilisation, but they are not numerous.

The fauna is very similar to Northern Queensland. Wallabies are very numerous, but the blacks prevent them from becoming a pest. Kangaroo and emu are found. The opossum is very scarce; he is of smaller type than our Southern Queensland one. Dingoes are very numerous. Certain tribes of the blacks keep them for hunting purposes. Small vermin, such as rats, bandicoots, are very rarely seen. Snakes are not plentiful. In eight months we only killed six snakes, and only one of these was venomous. Iguanas are found, but are smaller than the Queensland type.

Bird life is abundant. The common varieties of parrot, white and black cockatoos, are very numerous. Every evening, at sunset, great numbers of white cockatoos fly over to their roosting places. They have not yet acquired a taste for maize, but when they do they will be a very great menace to the farmer. The flying-fox is found in large numbers, but has to confine his attention to the native fruits. Pigeons are found in the jungles. The jackass strikes a homely note, but his laugh is a very feeble one, when compared with that of his southern cousin. As might be expected from the large area of swamps, waterfowl are numerous. The principal are geese, black duck, pigmy geese, white and blue cranes, and native companions. I expected to see waterfowl more numerous, as they are not shot at by white hunters, but as I found that during the breeding season the blacks collect thousands of eggs, this was the compensation of nature. Of predatory birds, the crow and hawk are plentiful.

Fish are found in the river and all the lagoons. The principal varieties are the so-called "barramundi" and mullet. I have had barramundi up to 75lbs. weight. The natives are expert fishermen. Prawns are found; they are of very large size, being from 5 to 6 inches in length. Whilst the joys of bathing in this climate are very great, he would indeed be very foolhardy to indulge in the pastime here, for the river is infested with crocodiles. The two species are found, the large estuarine "Crocodilus Porosus," and the smaller "Crocodilus Johnstonii." I have counted 8 in one mile of river length during a trip down the river. Anyone acquainted with the shy nature of these saurians can gather from this how numerous they are. They doze on the mud flat, and wait for the unwary wallaby or dog to come down to drink. They occasionally dine off a black. The blacks call C. Porosus (cheeky pfellah). During the floods the crocodiles come into the billabongs and swamps, as it is very difficult to get their prey in the flooded stream. It is very difficult to get them by shooting, as they always lie adjacent to the water, and even if badly hit, usually manage to glide into the water. Whilst owing to his natural timidity he is not aggressive on land, he would have to be considered as a menace to young stock.

Of insect life here house flies are not numerous, but the march fly is very severe on horses. The worst fly here is the small buffalo fly, which causes stock great annoyance. The buffalo himself only comes on to the river flats during the dry season. The mosquito is very bad up here. Immediately the sun sets one has to take shelter within a net or mosquito tent, and he is lulled to sleep by them. The anopheles variety is very abundant, and care has to be taken, as he

is a fever-bearing species. The white ant is a great pest here, but I must say it is not so bad here as in other parts ; but what it lacks in numbers it makes up in eating powers. The reason of their voracious appetite is the want of timber to feed on. Owing to the annual bush fires, all logs are burnt up, and, in consequence, the ant has to devour anything it can get.

The last and most important feature of this locality is its climatic conditions. Situated as it is within Latitude 13° and 14° South, the conditions are tropical. There are two distinct seasons, the wet and dry, and the conflict of opinion is owing to the fact of some describing it during the wet and others the dry.

The dry season commences in April, and lasts until November. Only rarely does the wet season start in November. The mean rainfall for May, June, July, and August, is less than ½ inch, and as a rule these months are practically rainless. Day after day the sky is a bright blue, and one may live out in the open. The mornings are cool. I kept a thermometer reading for shade temperature during twelve months, and found that the minimum was 49° Fahrenheit. On the 22nd, 23rd and 25th June, the reading at 6 o'clock in the morning was 49°, 50°, and 51° F., but the maximum readings for those days were 89°, 94°, and 96°. The nights are fairly cool, the temperature being usually about 70° F. The highest reading recorded was in November, when the temperature was 104°, but during this month the temperature was nearly always above 97° ; but as the air is dry it is not oppressive.

The wet season extends from November to April. The rain usually falls just after midday, and is accompanied by heavy thunder and lightning. In the middle of the wet season, it rains nearly every day, but not so continuously as down in Southern Queensland. Very rarely is there more than two days' continuous downpour. During each storm usually 2 to 3 inches falls. The greatest day's rainfall recorded in the Territory is 14 inches, at Boroloola, in 1899. Whilst the storm is raging the temperature is about 70°, and quite pleasant, but when the sun comes out again the weather is very oppressive, as the humidity is enormous. This is particularly the case during January, February, and March, and the nights especially under a close mosquito net are stifling. It is not advisable to overheat one's-self, but when working in the shade conditions are much better. The best means for avoiding the heat of the day is to commence work at daylight, and only work in the shade from 11 a.m. to 3 p.m., and then resume work in the field from 3.30 until dark. Whilst I must say it is very difficult to work for a continuous period, any person working

for himself and taking judicious intervals of rest will soon adapt himself to the climate. One is not capable of the persistent effort that can be done further south, and a hard taskmaker would soon make life intolerable, especially if working out in the open sun.

In spite of the advantages of nature here, the primary development is a very stupendous undertaking, and the only chance of success is to get the settler with that inherent love of the soil, not the experimental faddist who has been lured by the cry of " go on to the land." He who comes here must be alive to all the difficulties, and be content to become part and parcel of the place that he lives in, and not for ever hoping for a home in another land. He must have that sentimental pride, his conquest of the virgin land, and cultivate the domestic ties that make home and nationhood.

In the past the settlers here have been of the nomadic type, lightly come, lightly go, ever restless, railing at their lot, and making no attempt to settle permanently. The other factor, the necessity for railway communication is so obvious, that comment is unnecessary. The prohibitive fares from any of the Australian capitals is also a detriment to any influx of population. Whilst recognising the fact that each and every State needs all the population that it can get to fill their empty spaces (and we in Queensland especially so), a nucleus of Australians from other States is absolutely necessary to form a primary settlement here. For here is land of the finest quality (close to the teeming millions of the East) available at cheap rates, and its fundamental characteristics are essentially Australian. But let none go to lightly conquer.

RAINFALL FOR YEAR, 1912-1913.

	Apl.-Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April
1	Nil.	..	..	..	..	..	..	..	..
2	..	..	..	..	0.04	0.13	..	..	..
3	..	..	..	..	0.10	..	0.27	0.90	..
4	..	..	..	..	..	..	3.10	0.20	..
5	..	..	..	0.09	..	0.45	1.62	..	..
6	..	..	..	0.09	..	1.19	1.01	0.51	..
7	..	..	..	..	0.30	0.43	1.97	1.04	..
8	..	..	..	..	..	..	2.95	0.85	..
9	..	..	..	0.17	0.93	..	2.15	..	..
10	..	..	..	..	..	0.30	0.75	..	..
11	..	..	..	0.98	..	0.08	..	..	..
12	..	..	..	..	..	0.03	..	..	..
13	..	0.16	..	..	..	..	..	0.09	..
14	..	..	..	..	..	0.45	..	0.13	..
15	..	..	..	0.20	..	0.10	..	1.07	0.24
16	..	..	0.50	..	..	1.35	..	1.62	..
17	..	..	..	..	..	0.16	2.22	..	..
18	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	0.18	..	..
20	..	..	..	..	..	0.16	0.04	..	..
21	..	..	0.02	..	..	0.25	0.16	..	..
22	..	..	..	0.18	..	..	1.32	..	..
23	..	..	0.04	..	0.28	0.05	0.55	2.16	0.07
24	..	..	..	0.30	0.56	0.42	..	..	..
25	..	..	..	..	0.23	0.54	..	0.32	..
26	..	..	..	..	..	0.40	..	..	..
27	..	..	..	..	..	..	..	1.12	..
28	..	..	..	..	..	..	..	..	..
29	..	..	..	0.07	0.68	0.25	..	2.04	..
30	..	..	0.26	..	..	1.20	..	0.04	..
31	..	..	0.62	..	0.37	1.60	..	..	..
Tot'l	Nil	0.16	1.44	2.08	3.49	9.54	18.29	12.09	0.31

Total, 47 inches 1 point, 47.1.

J. J. Cummins,

Daly River, 1913.

APPENDIX.

PRINCIPAL TREES OF DALY RIVER DISTRICT.

(1) Malaleuca leucodendron L.N.O. Myrtacor, broad-leaved tea-tree or Cadjeput. There are two types, one found in sandy ridges, and is short ; the other grows in swamps, and attains a height of 60 or 70 feet. It is very durable in the ground, and the white ants do not eat it very readily. Bark good for thatching.

(2) "Pandanus spiralis," has loose, fibrous trunk ; bears a fruit which the natives cook and eat.

(3) Petalostigma quadriloculars or quinine tree, bears a very acrid yellow plum, does not grow very high ; found on low, sandy flats.

(4) Rhizophora mucronanta mangrove. The common red mangrove.

(5) Santalum lanceolatum "sandalwood," bears a purple fruit ; wood polishes very well ; only grows to about 10in. diameter ; found in low-flooded jungle land.

(6) Sarcocephalus cordatus, Leichhardt pine, has a grey fluted bark ; wood very yellow and soft ; grows along the river and in low land. The natives eat the fruit, which is like a large quandong.

(7) Sestania grandiflora, or cork tree, grows along the creeks ; natives eat seed.

(8) Sterculia acerifolia (flame tree), grows on edge of jungle ; has beautiful crimson flowers, hence the name.

(9) Sterculia quadrifida, kurrajong. It is deciduous. It has a soft, fibrous wood ; natives make hempen nets from it.

(10) Fristania suaveoleus or freshwater mangrove, also known as water gum ; found along all the flooded billabongs. A very springy resilient wood, used for handles and waddies.

(11) Adansonia Gregorii, or baobab ; a large big-trunked tree of fig type, deciduous ; found on river bank.

(12) Bombay Malabaricum, Simool, or native kapock ; natives use gum, also make canoes and woomeras out of wood, which is very easily worked.

(13) Callitris verrucosa, Cypress pine, a white ant resisting wood, has a resinous scent ; grows on the sandy granite ridges.

(14) Erythrina vespertibo, or cork tree ; a deciduous tree, with light fluted bark ; used by natives for shields and coolamons.

(15) Eucalyptus rostrata or flooded gum ; does not attain great height here.

(16) Excaecana parviflora, or gutta percha tree ; grows in flat, swampy ground ; exudes a whitish mucous liquid which hurts the eyes if it gets in them ; an ornamental wood.

Ficus, several species.

None of these trees, except the tea-tree and kapock, exceed 2 feet in diameter, and their general height is from 25 to 40 feet.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

28TH ANNUAL GENERAL MEETING.

AUGUST, 18TH, 1913.

Hon. F. T. Brentnall, M.L.C., FELLOW, President of the Society, occupied the chair.

The attendance was large.

The Minutes of the previous Monthly Meeting were taken as read, and duly confirmed.

A communication was read from His Excellency Lord Denman, Governor-General, who regretted his unavoidable absence from the meeting.

The Hon. Secretary and Treasurer (Dr. J. P. Thomson) read the Annual Report of the Council, and submitted the financial statement duly audited, both of which were adopted, on the motion of Messrs. John Cameron and W. M. L'Estrange.

The President then delivered the Anniversary Address, dealing chiefly with the Panama Canal. The vote of thanks to the President for his address was moved by Mr. James Stodart, M.L.A., seconded by Mr. John Cameron, supported by Dr. Thomson, and carried by acclamation.

The following officers and council were then elected :—

OFFICERS AND COUNCIL NOMINATED FOR SESSION 1913-14.

PATRON :

HIS EXCELLENCY SIR WM. MACGREGOR, G.C.M.G., C.B., M.D., LL.D., D.Sc.

PRESIDENT :

JAMES STODART, ESQ. (FELLOW), M.L.A.

VICE-PRESIDENTS :

JOHN CAMERON, ESQ. (FELLOW). E. E. EDWARDS, ESQ., B.A.

HONORARY SECRETARY AND TREASURER :

DR. J. P. THOMSON.

OTHER MEMBERS OF THE COUNCIL :

HON. F. T. BRENTNALL, M.L.C. (FELLOW).
GEORGE PHILLIPS, ESQ., C.E. (FELLOW)
W. M. L'ESTRANGE, ESQ., A.M.I.E.E.
A. A. SPOWERS, ESQ. (FELLOW).
HON. W. F. TAYLOR, M D., M.L.C.
ALEXR. CORRIE, ESQ. (FELLOW).
HON. T. C. BEIRNE, M.L.C.
W. R. PARKER, ESQ., L.D.S., Eng.

Light refreshments were afterwards served, and an inspection made of an exhibit of beautiful Indian and African fabrics, kindly lent for the occasion by Mrs. H. Tryon.

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

REPORT OF COUNCIL, 28TH SESSION, 1912-13.

In submitting the Twenty-eighth Annual Report, for the Financial Year ending June 30th, 1913, the Council has pleasure in alluding to the sustained public interest in the work of the Society, as evidenced by the attendance at Monthly Meetings and the addition of new Members to the Roll, including a young Lady Member and his Excellency Lord Denman, the distinguished

Governor-General, who has been pleased to associate himself with the geographical progress of Queensland as a supporter of the Society, thereby recognising its public utility and honourable position among the scientific institutions of the world. The losses sustained by death include The Honourables Felix Clewett and Lewis Thomas, both members of the State Legislature, and greatly valued supporters of the Society.

The accompanying Financial Statement shows the current credit balance in the Bank to be £91 5s. 7d. In addition to this there is the Thomson Foundation Gold Medal Fund, amounting at the close of the period under review to £286 14s. 6d. Of this capital sum £280 are vested in Royal Bank Preference Shares, the balance being deposited in the Government Savings Bank at current rate of interest. The Fund as a whole, which will soon have reached the full amount originally stipulated, and will then be self-supporting, is under the management of three Trustees, Sir Arthur Morgan, Mr. George Phillips, and Dr. J. P. Thomson.

The Library Catalogue Fund has been increased by donations received from the Honourables R. M. Collins and E. J. Stevens, Messrs. John Cameron, P. W. Cameron, and the President, to whom the thanks of the Council are due.

Popular addresses, with lantern-slide illustrations, have been given during the sessions, as follows :—

"Explorations in Australia," by Dr. Eric Mjöberg.

"Dr. Livingstone's Footprints in the Sands of Time," by the Hon. F. T. Brentnall, M.L.C. (President).

"Captain Scott's Death," by George Phillips, C.E.

"Review of Antarctic Exploration," by Dr. J. P. Thomson, Hon. Secretary and Treasurer.

"Weather Lore," by E. C. Barton, M.I.E.E.

"The Panama Canal," by the Hon. F. T. Brentnall, M.L.C. (President).

Exhibition of Lantern Slide Pictures on French Royal Life and Residences, Public Architecture, and the Revolution, by Miss Alison Greene, Principal, Moreton Bay Girls' High School.

While thanking the authors of these addresses, the Council would be glad to welcome papers or lectures from such Members and friends of the Society as may be in a position to contribute useful information on any geographical subject of interest.

Following the usual course the Council recommends :—

(1) The suspension of so much of the rules as provides for the payment of an entrance fee ;

(2) The re-appointment of Mr. E. E. Edwards, B.A., as Librarian ; of Mr. Robert Fraser, as Honorary Auditor ; and of Mr. H. W. Mobsby, as Honorary Lanternist ;

(3) The appointment of Sir Arthur Morgan, and re-appointment of Messrs. Robert Fraser and Alexr. Muir as Hon. Members of the Council.

While cordially thanking all those who have contributed to the successful work of the Session, the Council specially desires again to acknowledge the valuable services rendered by Mr. H. W. Mobsby as Honorary Lanternist, and Mr. Robert Fraser, as Honorary Auditor.

STATEMENT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

FROM THE 1ST JULY, 1912, TO 30TH JUNE, 1913.

Dr.

	£	s.	d.	£	s.	d.
By Funds at close of last Account—						
,, Bal. in Govt. Savings Bank ..	38	17	8			
,, ,, Royal ,, ...	37	7	11			
				76	5	7
,, Annual Subscriptions, etc., Received	165	8	9			
				165	8	9
,, Interest on Govt. Savings Bank Deposit	0	9	9			
				0	9	9
,, Donations to Library Cataloguing Fund	8	4	0			
				8	4	0
				£250	8	1

Cr.

	£	s.	d.	£	s.	d.
To Expenditure as per Accounts—						
,, Gas Accounts	2	7	0			
,, Fire Insurance Premiums	3	8	6			
,, General Postage and Printing Notices of Meetings	27	7	3			
				33	2	9
,, Library Catalogue	31	10	0			
				31	10	0
,, Advertising Meetings	2	3	0			
,, Cleaning and Repairing	23	4	6			
,, Expenses of Meetings, Cablegrams, &c.	26	13	9			
,, Incidentals	4	5	9			
				56	7	0
,, Hon. Treasurer	30	0	0			
,, Stationery	7	4	9			
				37	4	9
,, Exchanges	0	7	0			
,, Bank Charges	0	11	0			
				0	18	0
,, Bal. in Royal Bank	82	4	2			
,, Bal. in Govt. Savings Bank ..	9	1	5			
				91	5	7
				£250	8	1

Examined with Bank Pass Books, Vouchers, etc., and found correct.

ROBT. FRASER, Hon. Auditor.

21st July, 1913.

J. P. THOMSON, Hon. Secretary and Treasurer, 21/7/13.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

29TH ANNUAL GENERAL MEETING.

JULY 27TH, 1914.

Mr. James Stodart, M.L.A., FELLOW, President of the Society, occupied the chair. There was a large attendance.

The Minutes of the previous monthly meeting were taken as read, and duly confirmed.

Apologies for absence from the meeting were read from His Grace, Dr. Duhig (Coadjutor Archbishop), Messrs. George Phillips, and W. M. L'Estrange.

On the nomination of the Hon. Secretary and Treasurer, His Excellency the Rt. Hon. Sir Ronald C. Munro-Ferguson, P.C., G.C.M.G., Ald. C. P. Buchanan, B.A., Hon. Arthur Herbert Whittingham, M.L.C., and George Kenilworth Seabrook, J.P., were elected members of the Society.

The Hon. Secretary and Treasurer (Dr. J. P. Thomson) read the Annual Report, and submitted the financial statement, duly audited, both being adopted on the motion of the Hon. J. W. Blair, M.L.A., seconded by Hon. W. F. Taylor, M.D., M.L.C.

The President then delivered the Anniversary Address.

The vote of thanks to the President for his address was moved by Mr. E. W. Walker, seconded by Dr. H. C. C. Shaw, and carried by acclamation.

In the absence of the author, Dr. Thomson read a paper by Mr. J. J. Cummins, Authorised Surveyor, on the Daly River, Northern Territory, illustrated by lantern slides, screened by Mr. H. W. Mobsby, Hon. Lanternist.

The vote of thanks to the author of the paper was moved by Mr. Alex. Muir, seconded by Mr. P. J. Nally, and carried unanimously.

The following officers and council were then elected:—

OFFICERS AND COUNCIL NOMINATED FOR SESSION 1914-15.

PATRON:

HIS EXCELLENCY SIR WILLIAM MACGREGOR, G.C.M.G., C.B., M.D., LL.D., D.Sc., HON. F.R.S.G.S. (Edin.), Etc.

PRESIDENT:

HON. J. W. BLAIR, M.L.A.

VICE-PRESIDENTS:

HON. W. F. TAYLOR, M.D., M.L.C. E. W. WALKER, ESQ., J.P.

HON. SECRETARY AND TREASURER:

J. P. THOMSON, LL.D., HON. F.R.S.G.S. (Edin.)

OTHER MEMBERS OF COUNCIL:

JAMES STODART, ESQ., M.L.A. (FELLOW)

ALLAN A. SPOWERS, ESQ., J.P. (FELLOW)

ALEXANDER CORRIE, ESQ, J.P. (FELLOW)

HON. F. T. BRENTNALL, M.L.C. (FELLOW)

GEORGE PHILLIPS, ESQ., C.E. (FELLOW)

W. M. L'ESTRANGE, ESQ., M.I.E.E.

B. DUNSTAN, ESQ., F.G.S.

ALD. ALEXANDER McLEOD, J.P.

On the motion of Dr. Thomson, the retiring President, in vacating the chair in favour of his successor, was accorded a vote of thanks by acclamation.

Light refreshments were then served, and afterwards there was an inspection of a unique exhibit of scientific instruments, minerals, native curios, etc., kindly exhibited by Mr. H. H. Hamley, C.E., who briefly described them. Several gramophone selections were also given by Mr. E. C. Barton, F.R.G.S.

The meeting closed with hearty votes of thanks to Messrs. Mobsby, Hamley and Barton.

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

REPORT OF COUNCIL, 29TH SESSION, 1913-14.

The Council has the honour of submitting to the Fellows and Members the Twenty-ninth Annual Report on the operations of the Society for the Financial Year ending June 30th, 1914. In alluding to the successful work of the Session much gratification is felt at the general interest shown in the various subjects treated at the monthly meetings, and the addition of over fifty new members to the Roll, including a lady and four Life Members.

It is, however, with deep regret that reference is made to the heavy losses sustained by the death of some of the earliest supporters of the Society, including John Cameron, Hon. E. B. Forrest, George Fox, J. H. McConnell, Hon. Alex. Raff, W. J. Scott, and Sir John Murray, an Hon. Member, and one of the greatest oceanographers of modern times.

By the Financial Statement hereto appended the credit balance in the Bank is shown to be £106 8s. 9d. In addition to this there is also the Thomson Foundation Medal Fund, the donations and interest thereon of which have been invested in the purchase of 30 Royal Bank Preference Shares of £10 each. This stock is now earning dividends at the present rate of 5½ per cent., and returns £16 10s. per annum, which, it is gratifying to note, will be available annually for the purchase of a medal, as originally intended when the fund was established. For the first time in the history of the Society, the Council is thus enabled to fulfil the wishes of the originators of the Gold Medal, which henceforth will be awarded annually to the author of the best original contribution to Geographical Literature, approved and accepted by the Council, or to such persons as may have rendered signal services to the Society.

The valuable and numerous additions to the Library include the usual exchanges and donations from private sources, all of which have been duly recorded, and are available to the members who may desire to make use of them.

The programme of the Session included several popular addresses, with lantern-slide illustrations, as follows :—" Glimpses of Canada, including the Niagara Falls," by Mr. W. R. Parker, L.D.S. (Eng.) ; " A Tour Through Europe and America," by the Rev. Father M. O'Flynn ; " Halley's Comet and Associated Celestial Phenomena," by Dr. J. P. Thomson, Hon. Secretary and Treasurer ; " London, the Imperial Port and Market of the World," by Mr. J. H. Estill, Superintendent for the Port of London Authority ; " Some Beauty Spots of New South Wales," by the Hon. F. T. Brentnall, M.L.C. ; " Picturesque New Zealand," by Mr. C. W. Costin ; " An Unconventional Visit to Scenic Japan and Her People—and a fair interpretation of both," by Mr. W. G. Vieth, of Tokyo ; and lastly we are having this evening a paper by Mr. J. J. Cummins on the " Daly River, Northern Territory," with numerous slide pictures.

To the authors of these interesting and valuable communications the thanks of the Council are due.

Following the course adopted for some time past, the Council has the pleasure of recommending :—

(1) The suspension of so much of the " Rules " as provides for the payment of an entrance fee ;

(2) The re-appointment of Mr. Robert Fraser, as Hon. Auditor, and of Mr. H. W. Mobsby as Hon. Lanternist ;

(3) The re-appointment of Sir. Arthur Morgan and Messrs. Robert Fraser and Alexander Muir as Hon. Members of the Council.

While cordially thanking all those who have contributed to the successful work of the Session, the Council desires to especially acknowledge the valuable services rendered by Mr. H. W. Mobsby as Hon. Lanternist ; and Mr. E. E. Edwards, B.A., the retiring Hon. Librarian.

In alluding to the satisfactory position in which the Society now stands, the Council regrets the absence of their Excellencies Lord Denman, late Governor-General, and Sir William MacGregor, State Governor, the former being one of our comparatively new members, and the latter one of our earliest corresponding members, famous alike as an explorer, Empire builder, and administrator. On the eve of their departure from this country, the Council was favoured with a farewell message from each, and as indicating the estimation in which our Society is held by His Majesty's representatives, these are hereto appended for the information of our members generally.

The following Statement shows the investment of the contributions received in connection with THE THOMSON FOUNDATION MEDAL FUND of The Royal Geographical Society of Australasia, Queensland.

The Donations and interest thereon have been invested in the purchase of 30 Royal Bank Preference Shares of £10 each,—

26 at £10	£260
4 at £10 10s.	42
Face value	£300

This Stock earns Dividends at the present rate of 5½ per cent., and returns £16 10s. per annum, which will be available annually for the purchase of a medal.

In addition, there remains a Balance to credit of the Fund in the Government Savings Bank of 18s. 9d.

STATEMENT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

From 1st July, 1913 to 30th June, 1914.

Dr.

	£	s.	d.	£	s.	d.
By Funds at close of last Account—						
,, Bal. in Govt. Savings Bank	9	1	5			
,, ,, Royal ,, ...	82	4	2			
				91	5	7
,, Subscriptions Received	205	9	3			
				205	9	3
,, Interest on Govt. Savings Bank Deposit	0	5	5			
				0	5	5
				£297	0	3

Cr.

	£	s.	d.	£	s.	d.
To Expenditure as per Accounts—						
,, Gas Accounts	0	18	10			
,, Fire Insurance Premiums	3	9	0			
,, General Postage and Printing Notices of Meetings	33	15	7			
				38	3	5
,, Advertising Meetings	2	0	6			
,, Cleaning, etc.	15	8	0			
,, Expenses of Meetings, etc.	16	19	10			
,, Repairing Gas Fixtures	2	13	9			
,, Typeing	3	14	7			
,, Funeral Expenses	2	2	0			
,, Incidentals	7	7	8			
				50	6	4
,, Stationery	5	0	4			
,, Hon. Treasurer	30	0	0			
,, Petty Cash	4	2	6			
				39	2	10
,, Printing "Journal"	61	19	2			
				61	19	2
,, Exchanges	0	8	9			
,, Bank Charges	0	11	0			
				0	19	9
,, Bal. in Royal Bank	97	1	11			
,, Bal. in Govt. Savings Bank	9	6	10			
				106	8	9
				£297	0	3

Examined with Bank Pass Books, Vouchers, etc., etc., and found correct.

ROBT. FRASER, Hon. Auditor.

4th July, 1914.

J. P. THOMSON, Hon. Secretary and Treasurer, 4/7/14.

CORRESPONDENCE.

COPY.

COMMONWEALTH OF AUSTRALIA,
GOVERNOR-GENERAL,
Melbourne, 25th March, 1914.

Sir,

I am desired by his Excellency the Governor-General to thank you for your letter of the 16th March, and to request you to convey to the Members of the Royal Geographical Society of Australasia, Queensland, his appreciation of their kind expressions of regret at his departure from Australia.

His Excellency hopes that the Royal Geographical Society of Australasia, Queensland, in which he takes a deep interest, will continue its useful and prosperous career, and he will look forward to hearing from time to time the accounts of its proceedings, and the doings of its members.

Yours faithfully,
(Sgd.) Walter M. Barttelot,
Private Secretary.

The Hon. Secretary,
Royal Geographical Society of Australasia, Queensland.
Brisbane.

COPY.

11th July, 1914,
Government House,
Brisbane.

My Dear Dr. Thomson,

Will you kindly convey my sincere thanks to your Council for their good wishes, so kindly and courteously conveyed to me in your letter of the 8th inst.

I have been surprised to find you are in Brisbane, as I understood you had gone on leave. I wished to send you two papers the other day, but thinking you were absent, one I had sent to the Press on the expedition of Sir Rupert Clark on the Fly. The other was the Report of the International Commissions for fixing the position of the boundary between Kaiser Vilhelmsland and Papua. They give the latitude of my boundary post as 1/10th of a second out. Unfortunately thinking you were absent, I packed it up, and it is now inaccessible. You should have had it. I regret very much the mistake.

I thank you for all the many kindnesses I have had from you during so many years. I recognise the great and persevering industry, the indefatigable labour with which you have so ably maintained the Royal Geographical Society of Queensland.

I offer you cordial good wishes, with health and prosperity to you and yours,

Believe me,
Yours very sincerely,
W. MacGregor.

American Geographical Society,
Broadway at 156th Street,
New York City,
February 13th, 1914.

Dr. J. P. Thomson,
Honorary Secretary,
Royal Geographical Society of Australasia, Queensland.

My Dear Dr. Thomson,

Your letter informing me of my election as Honorary Corresponding Member of the Royal Geographical Society of Australasia, Queensland, was received with peculiar pleasure. I wish most heartily to thank the Society for the honour it has conferred upon me, and which is all the more highly appreciated, because it comes from a Society that has done so much good geographical work in the field, and produced so much good geographical literature in its publications.

With many thanks to you, Dr. Thomson, and renewed expression of my high esteem, I remain,

Very sincerely yours,
CYRUS C. ADAMS.

Queen's University,
Kingston, Ont.,
December 22nd, 1913.

J. P. Thomson, Esq., LL.D.,
Honorary Secretary,
Royal Geographical Society of Australasia.

Dear Dr. Thomson,

I have to acknowledge with many thanks your letter of the 10th November, informing me that I had been elected an Honorary Corresponding Member of the Royal Geographical Society of Australasia, Queensland.

I desire to convey, through you, to the Royal Geographical Society, my sincere appreciation of the distinction thus conferred upon me. I fear they have been induced to regard altogether too favourably any merits of mine for membership in such a Society, for although it has been my privelege to visit many countries, I regret that I have not been able to contribute seriously to the advance of geographical knowledge. If, however, appreciation of the distinction counts for anything as qualification for receiving it, then I can assure you I am quite worthy for I value it very highly.

With cordial greetings of the season, believe me,

Yours very faithfully,
DANIEL M. GORDON.

Royal Geographical Society,
Kensington Gore,
London, S.W.,
22nd December, 1913.

Dear Dr. Thomson,

I am greatly honoured by your letter of November 10th, informing me that I have been elected an Honorary Corresponding Member of the Queensland Branch of the Royal Geographical Society of Australasia.

I assure you I appreciate the honour highly. It would indeed be a great pleasure to me to visit Australia and the various branches of its Geographical Society. It would also be an honour if I were in a position to give a paper to the Queensland branch. I am afraid, however, that that pleasure is too remote to be practicable. I shall not be able to accompany the British Association to Australia, I am sorry to say. I do not know what might happen when I have more leisure than I have at present.

Yours very truly,
J. SCOTT KELTIE

Dr. J. P. Thomson.

Sydney, November 16th, 1913.

Sir,

I hereby have the honour to acknowledge the receipt of your letter of November 10th, conveying the information that I have been elected an Honorary Corresponding Member of the Royal Geographical Society of Australasia, Queensland.

It is needless to say that I appreciate this courtesy more than words can express, and I hope to show this appreciation of mine, at least to some small extent, by contributing in the way of lectures, etc.

I may add that I expect to return to Queensland some time next year, and shall then be very pleased to communicate with you regarding a second lecture in the presence of your illustrious Society.

I have the honour to be,
Sir,
Yours most sincerely,
ERIC MJÖBERG.

Dr. J. P. Thomson,
Hon. Secretary and Treasurer,
Royal Geographical Society of Australasia,
Queensland.

THE "BOER HOME."

There was not much "love lost" between the average colonial and "Johnny Boer" during the late war. "Active service" does not bring out one's best points, so, perhaps, the likes and dislikes one forms in the enemy's country may be intensified by the circumstances under which they are formed. The ordinary Boer farmer, or rather settler,—he is not a farmer; his crops are sown and tilled by the Kaffir, who does not work under a wage board. A piece of trek oxen, a little mealie meal, an occasional flogging with shambok (native whip), was about the whole of his wages. The Boer is contented with a simple home. Four stone or clay walls, a "lean to" thatch roof, he considers ample to hold his family, as a rule consisting of ten to fourteen children, all herded together under the same roof.

This does not improve the moral tone of family life. The Dutchman is "strong" on the Bible, but only to the extent of reading it. His religion does not seem to improve his way of living, and one must come to the conclusion that the moral tone of the average Dutch farmer's home is not high.

The women seem to have no ambition, no object in life. They take no pleasures in dress. They all invariably wear a hideous black sun bonnet, and old print dress, enough to blight any ideas the girls may have of looking becoming. During the last campaign, when the advance guard was approaching a farm, the whole family would sit out in a row in front of the house motionless, like waxwork figures (not the farmer himself, he was sniping on the nearest kopje) ; not a word out of them, all silent hidden in those " awful " sun bonnets. But once the troops had passed, and some unfortunate thirsty " Tommy " straggling behind came up for a drink of water, these dumb figures sprang into life. The Mauser rifle was fished out of its hiding place. Poor Tommy got his drink ; but once his back turned he was doomed, shot down like a dog. Towards the end of the war, it was necessary to remove all women to concentration camps, to burn all the farms to bring matters to an end. The writer assisted to burn many a one, and when the flames went up, the roof caught, the white flag toppled over ; you could then hear hundreds of rounds of Mauser ammunition exploding, concealed in the roof of the peaceful-looking farm house ; in fact each farm house was a perfect arsenal for the commandos to draw on. The Boer is a poor cattle man, takes no interest to improve his herd, always using the same sires or their progeny, as they started from the buffalo. They are a very poor lot.

One redeeming feature about their farms. They are mostly fond of a rose garden, and connected with the garden is a small " still," perhaps to make scent from the roses, or perhaps to make dopper gin. The Boer likes gin. The love of the rose is a great contrast to his other likes and dislikes.

The average cultivation is well watered. The art of irrigation is well known, probably inherited from the ancestors in the dyke land of Holland. They can almost make water run up-hill ; but, of course, all work is done by the nigger. Why should the Dutchman work ? Far easier to smoke the pipe of peace in the shade. The black man was made by the Almighty to dig irrigation ditches for his master. This is Boer logic.

Sun-dried foods form the bulk of the family's supply of food. Even the peach is smashed up and dried in the sun—in cakes. Mealie bread—good " hard tack " that will stand travelling. Sun-dried beef made into " billbong," all so handy when one is going on the " trek," and in the old days the Boer was always travelling, so the mode of preparing food is still carried on by the present generation. The Boer does not adorn the walls of his home with works of art. Some blown glass ornaments, purchased from the nearest " winkle " or Jew store are hung there. But at times objects of interest are found,—a British officer's sword from Majuba Hill, some silver buttons that once adorned the naval uniform of Van Tromp when he swept the English Channel. But one doubts if the owner knows the historic worth of them. So taking a common-sense view of the Boer and his home, it is " high time " that fresh blood settled in South Africa ; more vigorous life is infused in the community. The climate there is superb (except for violent thunderstorms). Now the British flag is flying there, we hope the Dutch characters will get out of its " old groove." The two nations blend together, and form a happy prosperous nation. The material is there, the old " Dutch home " will " go under," and its place taken by a healthy British South African one, always on the " up grade."

" OUT WEST."

Royal Geographical Society of Australasia,

QUEENSLAND.

FOUNDED 1885.

DIPLOMAS OF FELLOWSHIP.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 3, Constitution and Rules (*See page 2 of Cover*):—

Honorary:

His Excellency Sir William MacGregor, G.C.M.G., C.B., M.D., LL.D., D.Sc., Hon. F.R.S.G.S., etc.

The Right Hon. Lord Lamington, G.C.M.G., G.C.I.E., B.A., F.R.G.S., Hon. F.R.S.G.S., etc.

The Right Hon. Sir S. W. Griffith, G.C.M.G., M.A., etc.

Professor J. W. Gregory, D.Sc., F.R.S., Geological Department, University, Glasgow, Scotland.

Under subsections (a and b) :—

Charles Battersby, Esq., J.P.
Robert Fraser, Esq., J.P.
E. M. Waraker, Esq., J.P.
*R. M. Collins, Esq., J.P.
Alexander Muir, Esq., J.P.
C. B. Lethem, Esq., C.E.
*John Cameron, Esq., J.P.
Hon. Sir Arthur Morgan, Kt., F.R.G.S., etc.
Hon. C. F. Marks, M.D., M.L.C., etc.
Hon. F. T. Brentnall, M.L.C.
James Stodart, Esq., M.L.A.
J. R. Atkinson, Esq., L.S., J.P.
L. F. Schoenheimer, Esq., J.P.
Ald. John Crase, J.P.
L. C. Horton, Esq., J.P.
J. T. Embley, Esq., L.S.
Rev. L. L. Wirt, B.D.
Capt. W. C. Thomson.
R. H. Mathews, Esq., L.S., J.P., etc.
T. S. Sword, Esq , J.P.
George Phillips, Esq., C.E.
A. A. Spowers, Esq., J.P., etc.
A. S. Kennedy, Esq.
Alexr. Corrie, Esq., J.P.
Major A. J. Boyd.

*Dead.

LIST OF MEMBERS.

(P) Members who have contributed papers which are published in the Society's "Proceedings and Transactions." The numerals indicate the number of such contributions.

(PP) Past President.

A dagger (†) prefixed to a name indicates a member of the Council.

Life members are distinguished thus (*).

Should any error or omission be found in this list, it is requested that notice thereof given to the Hon. Secretary.

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P1 Allardyce, His Excellency Hon. W. L., C.M.G., Govt. House Falkland Islands.

Alton, R., Brisbane.

Armour, R. L., J.P., Brisbane.

P1 Atkinson, J. R., L.S., Ipswich.

Bailey, T. S., Survey Department, Brisbane.

P1 Bartley, N., Brisbane.

Bell, W., Supreme Court, Brisbane.

P1 Bennett, E. J., Survey Department, Brisbane.

Brydon, J. M., J.P., Brisbane.

Coghlan, J., Mount Eagle, Cooyar.

Daniell, E. N., Survey Department, Brisbane.

Davidson, W. M., Deputy Surveyor-General, Brisbane.

Drury, E. R., C.M.G., General Manager Q.N. Bank, Brisbane

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Fraser, T., L.S., Brisbane.

Gailey, R., J.P., Brisbane.

P9 PP Gregory, Hon. Sir A. C., K.C.M.G., M.L.C., F.R.G.S. &c., Brisbane.

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Heeney, F. X., J.P., Lands Department, Brisbane.

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P39 PP†Thomson, J. P., LL.D., Hon. F.R.S.G.S., etc., Hon. Sec. and Treasurer, Brisbane.
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Wilson, R. W., J.P., Brisbane.
Wilson, W. H., Brisbane.
P1 Woolnough, Rev. G., M.A., Brisbane.
Wright, H. T., Comm. R.N., Brisbane.

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B.I. and Q.A. Coy. (The Manager), Mary Street, Brisbane.

Blackman, A. H., Chief Engineer's Dept., Railway Offices, Brisbane.

†Blair, Hon. J. W., M.L.A., Secretary for Public Instruction, President, Brisbane.

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P4 PP †Brentnall, Hon. F. T., M.L.C., FELLOW, "Eastleigh," Coorparoo, Brisbane.

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Brown, J. Leonard, J.P., "Woggonora," Cunnamulla, Q.

Brown, Thos. H., J.P., Thos. Brown and Sons, Ltd., Eagle Street, Brisbane.

Browne, Sylvester, J.P., "Villa Marina," Sandgate, Queensland.

Bruce, Capt. J. A., Goode Island, via Thursday Island, Torres Strait, Queensland.

Bruce, Capt. William, "Haroldton," Mowbray Terrace, East Brisbane.

Buchanan, Ald. C.P., B.A., Auction Mart, Queen Street, Brisbane.

Bull, Arthur, Box 121, Durban, S. Africa.

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*Cameron, Pearson Welsby, J.P., Nicholas Street, Ipswich, Q.

*Campbell, A., J.P., Glengyle Station, Birdsville, Queensland.

Campbell, Norman, City Engineer's Office, Brisbane.

Carter, Hon. A. J., M.L.C. Royal Norwegian Consulate, Queen Street, Brisbane.

Cartledge, John Colenso, 56 Umbila Road, Durban, Natal, S. Africa.

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Carvosso, William Henry, J.P., Under Sheriff, Supreme Court, Brisbane.

Cherry, Frederick James, J.P., Mining Warden and P.M., Cooktown, Q.

Collins, C. J., Tamrookum, Beaudesert, Q.

Connah, T. W., I.S.O., Auditor-General, Brisbane.

Corrie, Leslie G., J.P., F.L.S., Bowen Terrace, Brisbane.

†*Corrie, Alex., J.P., FELLOW, "Parbury House," Eagle Street, Brisbane.

Costin, C. W., Parliament House, Brisbane.

P1 Crase, Ald. John, J.P., FELLOW, Warren Street, Fortitude Valley, Brisbane.

*Crorkan, T., J.P., ————

Crowe, P. W., 331 Queen Street, Brisbane.

Crowther, S., J.P., "Beechfield," Dornoch Terrace, South Brisbane.
Cusack, William George Kelly-, P.M., etc., Ravenswood, Queensland.
Pl Cummins, J. J., Authorised Surveyor, c/o Survey Office, Brisbane.

De Conlay, James, J.P., Warwick, Q.
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Deshon, C. E., L.S., M.S.E. (Lon.), Hydraulic Engineer's Dept., Brisbane.
Pl Dick, James, J.P., Cooktown, Q.
Doggett, Ald. Harry, J.P., 35 Arthur Street, Fortitude Valley, Brisbane.
Douglas, Henry Alexander Cecil, M.L.A., Parliament House, Brisbane.
†Dunston, Benjamin, F.G.S., Govt. Geologist, Brisbane.
Dunstan, Rev. R., River Terrace, Kangaroo Point, Brisbane.

Pl Edwards, Edward E., B.A., Telegraph Building, Brisbane.
Eden, D. R., J.P., "Barton Lodge," Hawthorne, East Brisbane.
Effey, William, J.P., Central Buildings, Edward Street, Brisbane.
Embley, J. T., FELLOW, L.S., Ascot Vale, Melbourne, Victoria.
Eschenhagen, E. C., Queen Street, Brisbane.
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Fairfax, J. Hubert, J.P., "Marinya," Cambooya, Q.
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Finlayson, W. F., M.P., "Blairadam," Roberts Street, Toowong, Brisbane.
Fish, George, J.P., South Brisbane.
Fisher, Rt. Hon. Andrew, P.C., House of Representatives, Melbourne, Victoria.
Fitzgerald, J. F., Solicitor, Messrs. Fitzgerald and Walsh, Queen Street, Brisbane.
Fletcher, Rev. M. Scott, M.A., B.D., B.Litt., Principal, King's College, River Terrace, Kangaroo Point.
*Foot, J. A., J.P., Warrinilla, Rolleston, Queensland.
Pl Ford, F. B. Campbell, Staff Surveyor, via Gayndah, Q.
Forsyth, James, M.L.A., "Braelands," South Toowong, Brisbane.
Fox, C. B., Messrs. Nicol Robinson, Fox & Edwards, Solicitors, Queen Street, Brisbane.
†Fraser, Robert, FELLOW, J.P., Brisbane.
Fraser, J. A., C.E., District Engineer, Railway Department, Brisbane
Fraser, Capt. C. Sankey, Queen Street, Brisbane.
Fristrom, Oscar, Queen Street, Brisbane.

*Gibson, D. W., Staff Surveyor, c/o Survey Office, Brisbane.
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Gore, F. J., Kwala Kubu, Federated Malay States.
Gorringe, J. A., Authorised Surveyor, Kempton, Tasmania.
Graham, Thomas, J.P., Magowra, Normanton, Q.
Graham, Mrs. Thos., Magowra, Normanton, Q.

Graham, Capt. J. N., Cooktown, Q.
Greene, Miss Alice J. Alison, Principal, Moreton Bay Girls' High School, Wynnum.
Greenham, Dr. Eleanor Constance, Edward Street, Brisbane.
Greensill, E. H. R., C.E., Authorised Surveyor, Chief Engineer's Dept., Railway Offices, Brisbane.
Gregory, F. W., "Rainworth," Bellevue Hill, Victoria Road, Rose Bay, Sydney, N.S.W.
Griffin, William Charles, J.P., Nelson, via Cairns, Q.
P1 PP Griffith, Rt. Hon. Sir S. W., G.C.M.G., M.A., LL.D., etc., Chief Justice of Australia, "The Albany," Macquarie Street, Sydney, N.S.W.
Grimes, R. F., Dentist, Valley Corner, Brisbane.
Groom, Hon. H. L., M.L.C., Toowoomba, Q.

Hamlyn-Harris, R. D.Sc., F.R.M.S., F.Z.S., F.E.S., etc., Director Museum, Brisbane.
Hannaford, S., J.P., "Utopia," Stanthorpe, Queensland.
Harbord, H. H., J.P., Maytown, Queensland.
Haviland, C. V., Govt. Land Buyer, Port Moresby, Papua.
Hayes, J. A., J.P., "Goonan Goonan," Sandgate, Q.
Hertzberg, A. M., J.P., Hertzberg & Co., Charlotte Street, Brisbane.
Hetherington, Ald. J. W., J.P., Main Street, Kangaroo Point, Brisbane.
Heussler, Fred. J., Authorised Surveyor, Survey Office, Brisbane.
*Hill, Mrs. Lumley, Belle Vue House, Bellevue, Q.
Hillcoat, Reginald E. R., J.P., Boomarra Station, via Donaldson, Queensland.
P1 Hirschfeld, Eugen, M.D., etc., Wickham Terrace, Brisbane.
*Hodel, F. C., J.P., Thursday Island, Torres Strait, Queensland.
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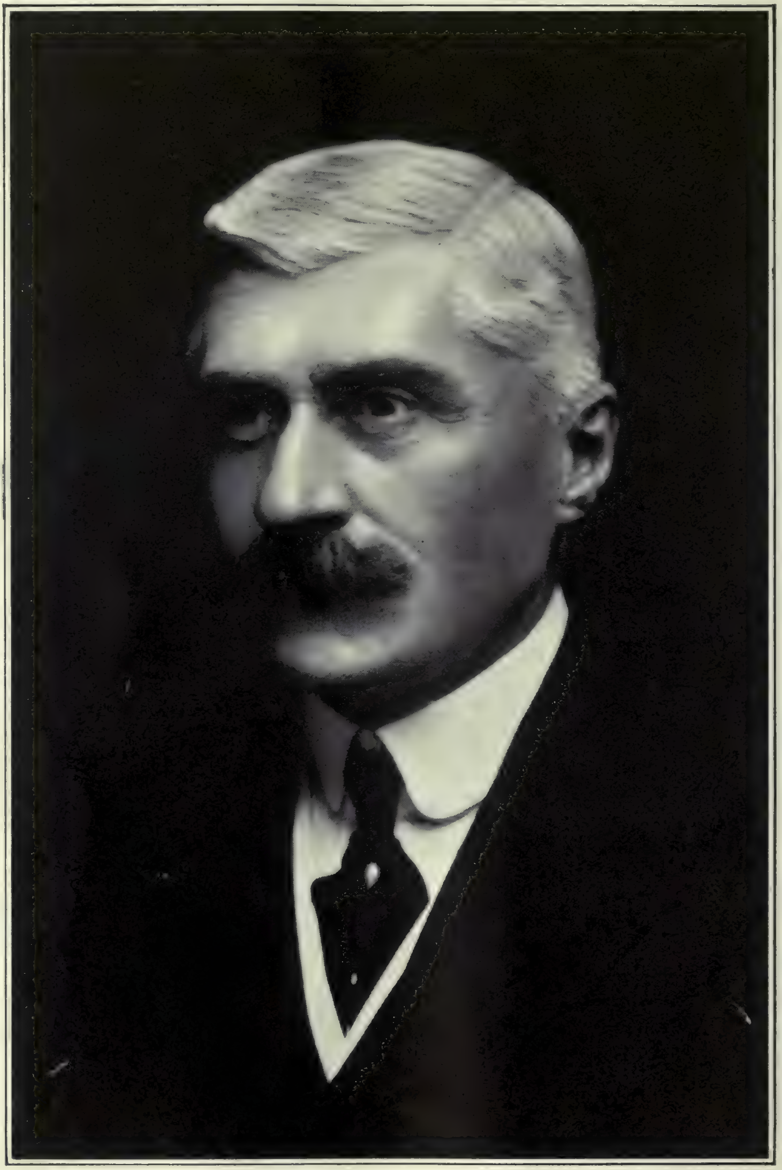

Hamilton Scott-Adams

President Royal Geographical Society of Australasia, Queensland.

Frontispiece.

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THE FLOWING WELLS OF WESTERN QUEENSLAND.

By Professor J. W. Gregory, D.Sc., F.R.S., Etc.

(*With Maps and Diagrams.*)

(*An Address delivered to the Royal Geographical Society of Australasia, Queensland, on 3rd September,* 1914.[1])

According to an inscription which I once read on the wall of a German inn, "Water is undoubtedly the best of all God's gifts." This unexpected temperance maxim was neutralised by the addition, "Modesty forbids me always to take the best." Under the plains of Western Queensland is the priceless gift of a vast store of water, and common-sense forbids that it should be wasted, for the future of Queensland largely depends upon its use; and one of the main problems of Australian Geology is concerned with its nature and probable duration.

The existence of subterranean water was first suggested by Tenison-Woods, in 1863, at a meeting of the British Association; and the idea was reasserted in 1879 in order to explain the comparatively small discharge of the Darling River. It was claimed that the Darling discharges only from one-twentieth to one-thirtieth of the proportion of the rainfall which is discharged by the Murray River; and this great difference was attributed to the percolation

[1] The invitation to give this lecture having been only given after my arrival in Australia, its preparation was necessarily very hurried; and it was only possible, thanks to the kind help in the loan of literature, preparation of diagrams, exhibition of specimens, and preparation of slides by Dr. Thomson, Mr. Dunstan and other officers of the Geological Survey, Dr. Richards, and Mr. Mobsby.

underground of the Darling water. These estimates have been abandoned, and the Darling is now admitted to discharge from one-third to two-thirds of the proportion discharged by the Murray; and even if the lower figure were accepted, the difference could be explained by the different geographical and climatic conditions of the two rivers. The recent figures support the conclusion advanced by your Secretary, Dr. Thomson, in 1896 and 1902, that evaporation adequately explains the relatively low discharge of the Australian rivers, and confirms the judgment of McKinney, in 1887, that no considerable percolation of water takes place from the western rivers of New South Wales except in their upper courses. The underground flow of the Darling was also maintained owing to the occurrence of patches of water of oily smoothness in the Great Australian Bight; they were explained as fresh water surging up through the denser water of the sea; and this fresh water, in spite of Dr. Thomson's protest, was regarded as river water which had disappeared in Queensland and New South Wales.

According to this view, one fundamental difference between Australia and the other continents would be that the main Australian river flows underground instead of on the surface; and it was hoped that, by the opening of many wells, this subterranean river would suffice to irrigate the arid plains of East-Central Australia.

During my residence in Australia, and especially during a visit to part of the area containing some of these flowing wells, I was led to doubt this hypothesis; my alternative explanation of the nature of these wells has been rejected by some Australian authorities, and I have been asked by Dr. Thomson to rediscuss the problem this evening, especially in reference to the new facts and opinions advanced during the past four years.

THE NATURE OF FLOWING WELLS.

It is probably unnecessary in this city and to this audience to explain the alternate views, but as they have been misunderstood a brief summary may be excused.

Flowing wells may be divided into two main groups; in some, as illustrated by the common diagram of an artesian well, rain-water which drains underground collects in a permeable bed which is sandwiched between two relatively impermeable beds, and has been folded into a trough or basin; and the pressure of the water

in the higher part of the water-bearing beds forces the water in the lower part of the trough to the surface. The water flows up such artesian wells for the same reason as it rises in our domestic water-pipes and up one arm of a V-shaped tube when poured into the other.

The second group of flowing wells includes those which overflow owing to other forces than water-pressure: Daubrée called them pelocones. These wells flow in consequence of several different agencies. The flow may be due to the weight of the overlying beds, which press down on the water-bearing beds and squeeze the water out of them if an outlet be opened from them by a bore. If a piece of wood with drilled holes through it be pressed down on a wet sponge, the water will be squeezed out of the sponge and escape up the holes; this experiment illustrates the nature of wells due to rock-pressure. A second kind of peloconic wells is due to gas-pressure; in many parts of the world are wells in which the water is lifted to the surface by the expansion of the gas dissolved in it, just as soda-water escapes from a soda-water syphon owing to the pressure of the included gas. If hot water enters a water-bearing bed, the increased temperature causes increased gas pressure; if a bore be sunk to the bed the water will rush through it until the gas pressure is relieved. This process is used in the air-lift pump, in which compressed air is forced to the bottom of a well, and the expanding air forces up the water, which thus overflows at the surface.

The overflow of oil-wells, though once attributed by some authorities to water-pressure, is also due mainly to gas-pressure.

The discharge from a peloconic flowing well varies in accordance with changes in the temperature and of the load above the water-bearing bed. In one case investigated by the Agricultural Department of the United States of America, the passage of a heavy freight train over an embankment causes the rise of the water in a well 140 feet away from the railway. As the entrance of hot deep-seated water into water-bearing beds is probably a slow process, wells bored into such beds often fail in time owing to the relief of the gas-pressure.

It is well to remember that water-pressure, gas-pressure, and rock-pressure may work together. A syphon of soda-water when standing upright discharges only by gas-pressure; but if the syphon be laid on its side water-pressure co-operates with the gas-

pressure. Similarly, in a series of inclined water-bearing beds charged with gas, both water-pressure and gas-pressure help in the escape of the water.

THE NATURE OF THE QUEENSLAND WELLS.

The problem in regard to the flowing wells of East-Central Australia is whether the wells discharge rain-water flowing owing to water-pressure, or whether they yield water of mixed origin, which flows in consequence of combined gas-pressure, rock-pressure, and water-pressure.

When these wells were first opened, Dr. Jack, with fine scientific insight, remarked that the water was too hot for the depths at which it was reached, and that the outcrop of the available intake beds was too low to give the necessary pressure. Hence he concluded that gas-pressure "greatly assisted" the uprise of the water. He remarked* that the water-pressure theory perfectly accounts for many of the artesian wells of Europe and America, but was inadequate for those of Queensland. Unfortunately, a year or so later, the boldness of his conclusion apparently led Dr. Jack to abandon it, and in the absence of the evidence now available it was natural that opinion was for long almost unanimous in favour of the simpler theory, that the wells overflow by water-pressure alone.

That theory had several recommendations. The flowing wells occur in a basin, which, though colossal, is a basin; and it contains water-bearing beds between impermeable clays above and below; and on the eastern margin of this basin are some beds of sandstones, which dip westward under the clays. These sandstones outcrop at a higher level than the plains to the west. Hence it was claimed that we have here all the conditions of a typical artesian basin. The famous Blythesdale Braystone was claimed as the permeable intake bed; and it was calculated that the absorption by this bed of 20 per cent. of the rain that falls upon it would maintain all the wells and also a sufficient overflow to keep the water in the basin fresh, by discharging northward to the Gulf of Carpentaria, southward to the Murray, and south-westward to the Great Australian Bight.

As a corollary to this theory it was held that, if the intake beds absorb a fifth of the rain-water that falls upon their basins,

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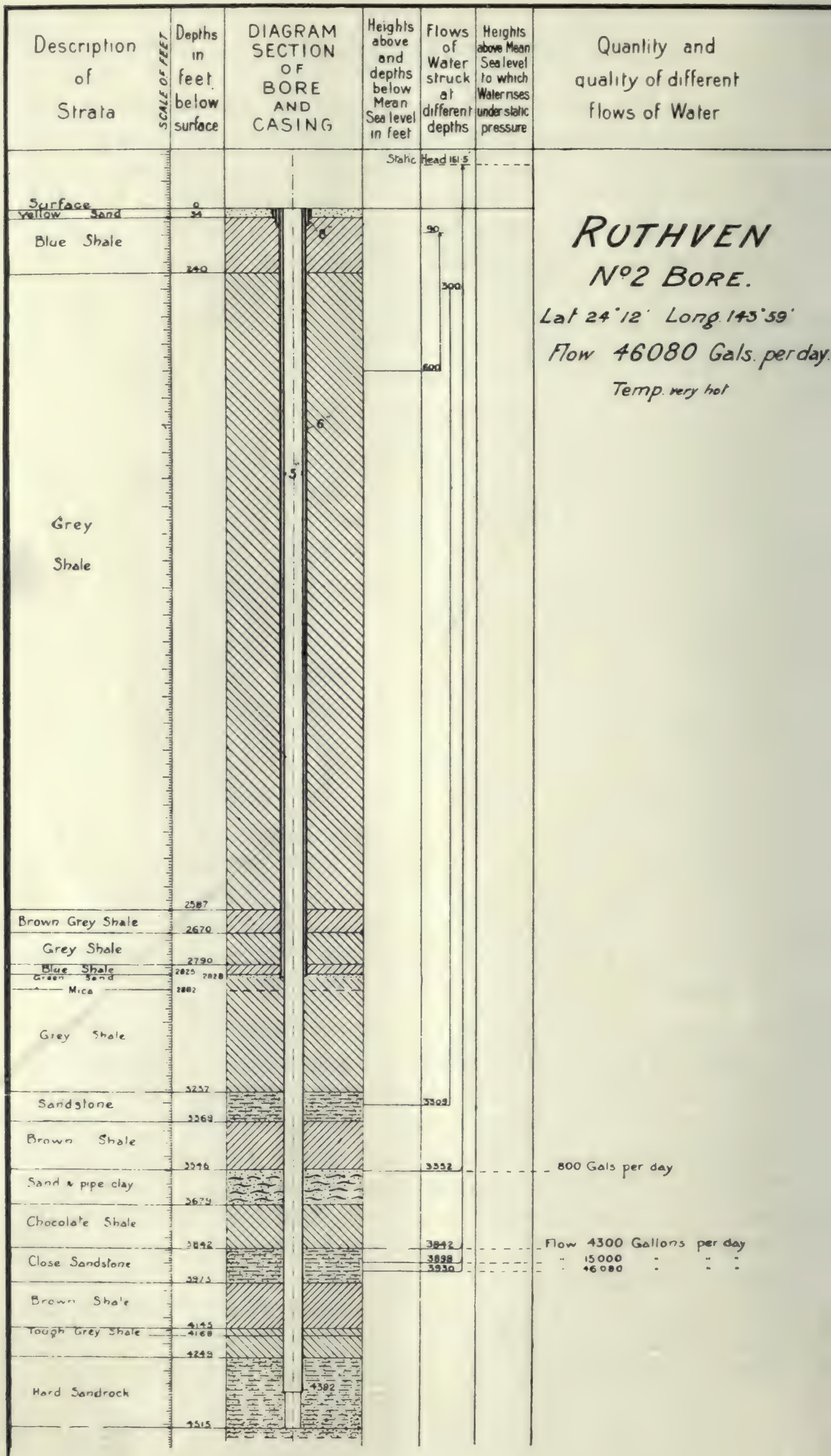
* In Jack and Etheridge, Geol. and Pal., Queensland, 1892, pp. 416-418.

this quantity would furnish a supply so many times greater than the discharge from the wells that there need be no fear of a diminution in their yield; hence it was held that it was quite unnecessary to control their flow. In accordance with the artesian theory it was held that there was no more need to stop the waste of water than to take steps to preserve the exhaustion of the sea; and in 1891 a Bill to control the flow from the wells, which had been passed by the Queensland Legislative Assembly, was accordingly rejected by the Legislative Council.

THE INTAKE BEDS.

The original artesian theory is, however, now dead; it has been abandoned by its former advocates, as one after another its foundations have collapsed. The difference between the relative discharges of the Darling and the Murray has dwindled to an amount which can be fully explained by the existing geographical and climatic differences. The supposed intake beds, known as the Blythesdale Braystones, have shrunk in area, and we are now told they are doomed to disappear alike from the artesian theory and from the maps. Four years ago I published outline maps, copied from those of the Geological Survey of Queensland, of all the Braystone areas, to show that the claim that these beds would act as a great intake was inconsistent with the official maps. The Braystone, though one of the chief foundation stones of water-pressure theory, has now been abandoned. Its area, according to the present view, was greatly overestimated, and the quality of the Blythesdale Braystone has changed as much as its quantity; for it is described by Messrs. Dunstan and Saint-Smith as the most impermeable bed in the district, instead of being of abnormal porosity.

The complete collapse of the original intake beds has rendered it necessary to discover another. The function formerly assigned to the Blythesdale Braystone is being transferred to the Jurassic beds. They appear, however, to be far less capable of supplying these wells than the Braystones. The area of Jurassic beds may be larger than that of the Blythesdale Braystones; but those who accept the Jurassic rocks as the intake hold that the maps of the Geological Survey of Queensland are so incorrect that the estimates of the intake areas founded on them are of no value. The demonstration that the bed which for thirty years we have been told was exceptionally absorbent is really a most impermeable rock does not encourage faith in the theory based on that hypothesis. The belief


Description of Strata
SCALE OF FEET
Depths in feet below surface
DIAGRAM SECTION OF BORE AND CASING
Heights above and depths below Mean Sea level in feet
Flows of Water struck at different depths
Heights above Mean Sea level to which Water rises under static pressure
Quantity and quality of different flows of Water
Static Head 161·5
RUTHVEN
Nº2 BORE.
Lat 24°12' Long. 145°59'
Flow 46080 Gals. per day.
Temp. very hot
Surface
Yellow Sand
Blue Shale
Grey Shale
Brown Grey Shale
Grey Shale
Blue Shale
Green Sand
Mica
Grey Shale
Sandstone
Brown Shale
Sand & pipe clay
Chocolate Shale
Close Sandstone
Brown Shale
Tough Grey Shale
Hard Sandrock
0
34
240
2587
2670
2790
2825
2828
2882
3257
3369
3546
3679
3842
3975
4145
4168
4249
4515
8"
6"
5"
4382
90
300
600
3309
3552
3842
3898
3930
800 Gals per day
Flow 4300 Gallons per day
" 15000 " " "
" 46080 " " "

that the Braystones are the intake has lasted for thirty years, but its successor will probably have a far shorter life, for the Jurassic beds are further away from the wells and require a greater elevation to give the same head. Instead of being all on the inland slope, large areas of them are exposed and drained by the steep slopes eastward to the Pacific. They are largely composed of impermeable rocks; thus, of the three divisions of these beds, according to Messrs. Walkom, Saint-Smith, and Thom, the lower beds contain "no porous beds"; the upper beds are slightly porous; and only the middle division consists of "very porous beds," and even these are described as "friable sandstones and shales with interbedded shales"; so that of the Jurassic outcrops only part, and apparently a small part, is porous.

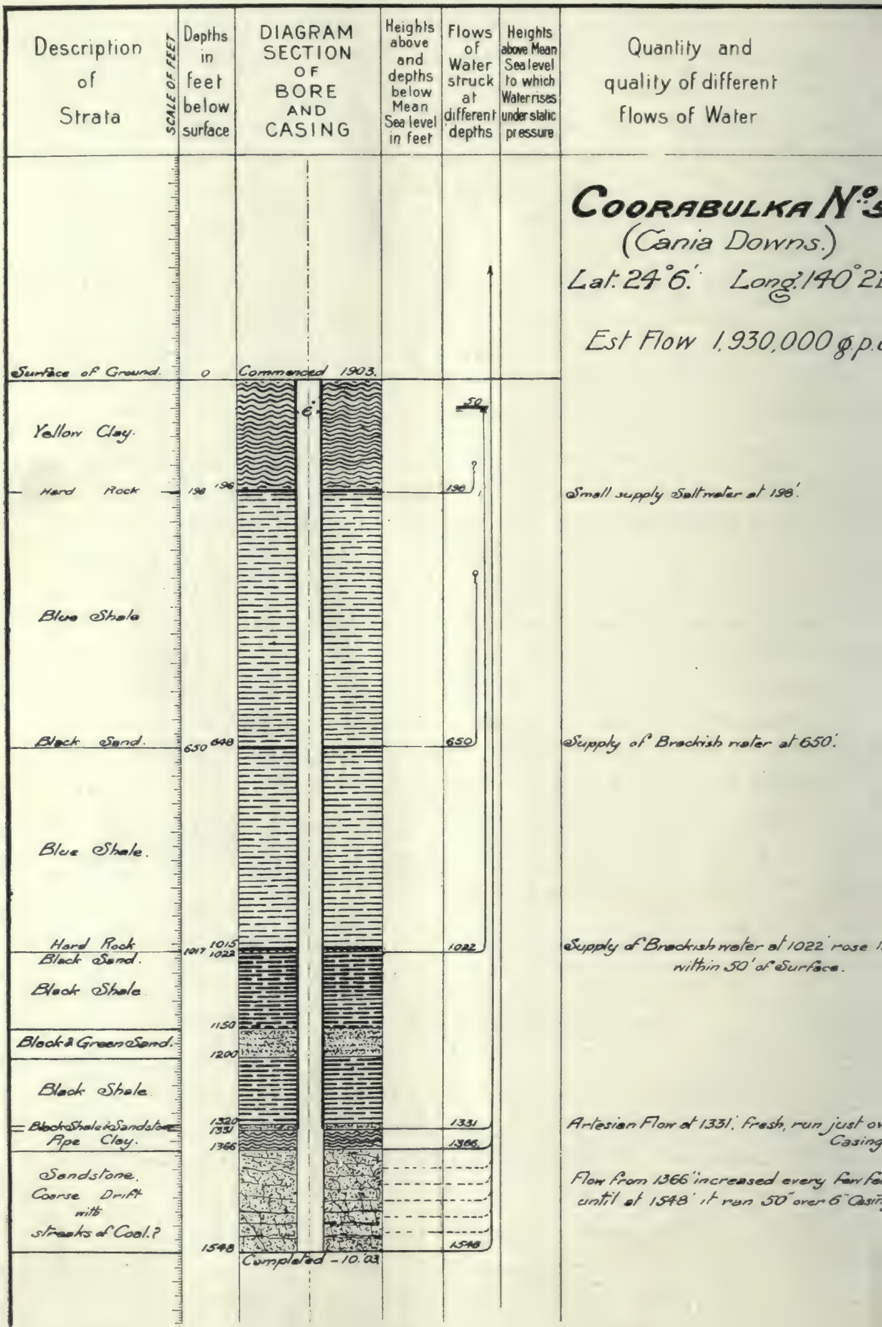
Reference to the bore sections show that the water-bearing beds are comparatively thin layers of sandstone included in thicker sheets of shale; the same is true in New South Wales, as shown by Mr. Symmonds' sections of the wells at Coonamble and Kialgara. In Queensland we find the same in many of the wells; thus, at Roma, the water came from the Upper beds and the Lower Jurassic beds are quite dry. Many of the bore sections, as at Tinderry, Coorabulka, Burra Burra, Mitchell, Ruthven No. 2, &c., show that the water comes from thin beds of sandstones which are separated by thick sheets of clay. Hence only a small part of the area of the Jurassic beds would be permeable and act as the intake.

Thus, at Ruthven No. 2 Bore, according to the section published by the Hydraulic Engineer (22nd Annual Report, Section No. 243), the rocks are as follow:—

	Feet.
Surface sands	34
Sandstone and clay	133
Sandstone without water	260
Sandstone yielding water	243
Shale	3,785

Mr. Walkom suggests that some of the rocks reported in the bore records as shale and clay may be sandstone; but if so, such sandstones would be waterless, for it is not probable that the borers would have failed to report the water-bearing beds.

If these Jurassic beds are the catchment for the artesian wells, why are these beds themselves so poor in water? Many bores, as at Dalby and Laidley, have been put down in these beds, and yielded small and often insignificant supplies. Nevertheless, we are asked


Description of Strata
SCALE OF FEET
Depths in feet below surface
DIAGRAM SECTION OF BORE AND CASING
Heights above and depths below Mean Sea level in feet
Flows of Water struck at different depths
Heights above Mean Sea level to which Water rises under static pressure
Quantity and quality of different Flows of Water
COORABULKA No. 5
(Cania Downs.)
Lat. 24° 6'. Long. 140° 2
Est Flow 1,930,000 g.p.
Surface of Ground.
0
Commenced 1903.
6"
50
Yellow Clay.
Hard Rock
198
196
198
Small supply Salt water at 198'.
Blue Shale
Black Sand.
650
648
650
Supply of Brackish water at 650'.
Blue Shale.
Hard Rock
Black Sand.
1017
1015
1022
1022
Supply of Brackish water at 1022' rose
within 50' of Surface.
Black Shale
1150
Black & Green Sand.
1200
Black Shale
Black Shale & Sandstone
1320
1331
1331
Artesian Flow at 1331'. fresh, run just ov
Casing
Pipe Clay.
1366
1366
Sandstone,
Coarse Drift
with
streaks of Coal.?
Flow from 1366' increased every few fe
until at 1548' it ran 50" over 6" Casin
1548
1548
Completed - 10.03

to believe that the Roma, and other wells to the west, flow only to the pressure of the water in beds which the bores show to be almost waterless.

Again, if the artesian water be rain-water which fell on the Jurassic rocks and percolated through them to the western bores, the water in the wells on the Jurassic outcrop should be fresher and purer than that which has travelled through these rocks for 100 miles or more. Yet the surface wells on the Jurassics contain water described as saline; while, according to Mr. Dunstan, the purest water yet found in any Queensland wells is at Morven, 80 miles from the nearest known Jurassic beds. Again, as Dr. Jensen has pointed out,* if the artesian water is collected in Jurassic basins, the most suitable situations for prolific artesian wells would be in the coastal basins, as at Grafton, and near Ipswich and Sydney, but bores sunk in these localities have failed to give rise to flowing wells.

The change of view in regard to the intake beds necessitates another important change—the abandonment of the supposed continuous water-bearing bed through which the water circulates throughout the artesian area as through a series of pipes. Instead of the water coming from one bed, it issues from many disconnected beds belonging to three horizons—Cretaceous, Jurassic, and Permo-Carboniferous. The conditions are, therefore, not analogous with those at Artois and in the London Basin, where the water comes through the chalk, one porous bed 800 feet or so in thickness.

That some of the water comes from the Cretaceous beds is clearly indicated by the well sections. According to Dr. Jack,† the wells at Rocklands, Tambo, and Cunnamulla obtain all their water from the Cretaceous beds, from which came also the upper flows from Charleville.

The Cretaceous origin of some of the water is shown by the well records published in the last annual report by the Hydraulic Engineers' Department. Thus, the wells at Tinderry and Burra Burra both obtain water from the limestone-bearing series, which is obviously the Cretaceous. In South Australia it is the same. Thus Professor David, in a corrigendum on the section published in the Federal Handbook for Australia, inserts the Patchawarra

* H. J. Jensen in Symmonds' "Our Artesian Waters," 1912, p. 73.

† In Jack and Etheridge, 1892, pp. 419, 425, 430, 427.

Bore, and shows that it derives its supplies from the Cretaceous rocks, whereas the adjacent wells are represented as in Jurassic.

The origin of part of the supply in New South Wales from the Permo-Carboniferous rocks was remarked years ago by Pittman and David for the well at Ballimore, north-east of Dubbo, and that some of the North Queensland water comes from the beds of this age has been recently suggested by Dr. Jensen.

Hence it appears that, if the intake beds are the Jurassic, the water from this formation percolates into the Permo-Carboniferous below and into the Cretaceous above; to reach them it must pass through varied deposits. Hence the idea that there is one continuous water-bed, through which the water flows as through a pipe, is fallacious; and the head due to water in the higher parts of Jurassic beds is not likely to pass on to the water in rocks belonging to other systems.

THE OUTLETS FROM THE CENTRAL BASIN.

Another fundamental principle of the old water-pressure theory was that the water in the central area was kept fresh owing to its continous renewal to replace that discharged into the sea. This discharge was attributed to four outlets. The outlets to the south and south-west have been generally abandoned; that to the sea at Brisbane is known not to be used by anything more than a mere trickle of water, even if by that; and to use the remaining outlet, that to the Gulf of Carpentaria, the water would have to rise from more than 4,000 feet below sea-level in the central basin over a barrier 400 feet above sea-level. Professor David* has justly remarked that on this hypothesis the facts are difficult of explanation. These difficulties may be realized by examination of Professor David's section across the basin; and they seem to me insuperable.

Professor David has suggested that the outlet may be by undiscovered channels through the rock barriers, or by the mound-springs on the south-western edge of the area; but neither suggestion seems probable. I once calculated the possible influence of the mound-springs by the amount of saline deposits that must have accumulated around them had any considerable proportion of the artesian water escaped through them.

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* **Federal Handbook, p. 278.**

THE TERM "ARTESIAN."

The four essentials of the old theory—the evidence for the great percolation of rain-water, the existence of the Blythesdale Braystone as the intake beds, the continuity of the subterranean water-beds, and the outlets judged necessary to keep the water fresh—have all failed to maintain their ground; and the old contention that there was no need to regulate the supply, which is the practical point concerned, has given place to stringent laws and regulations for the control of the water supply. And these restrictions, according to the pastoralists, are so injudicious as to be mischievous.

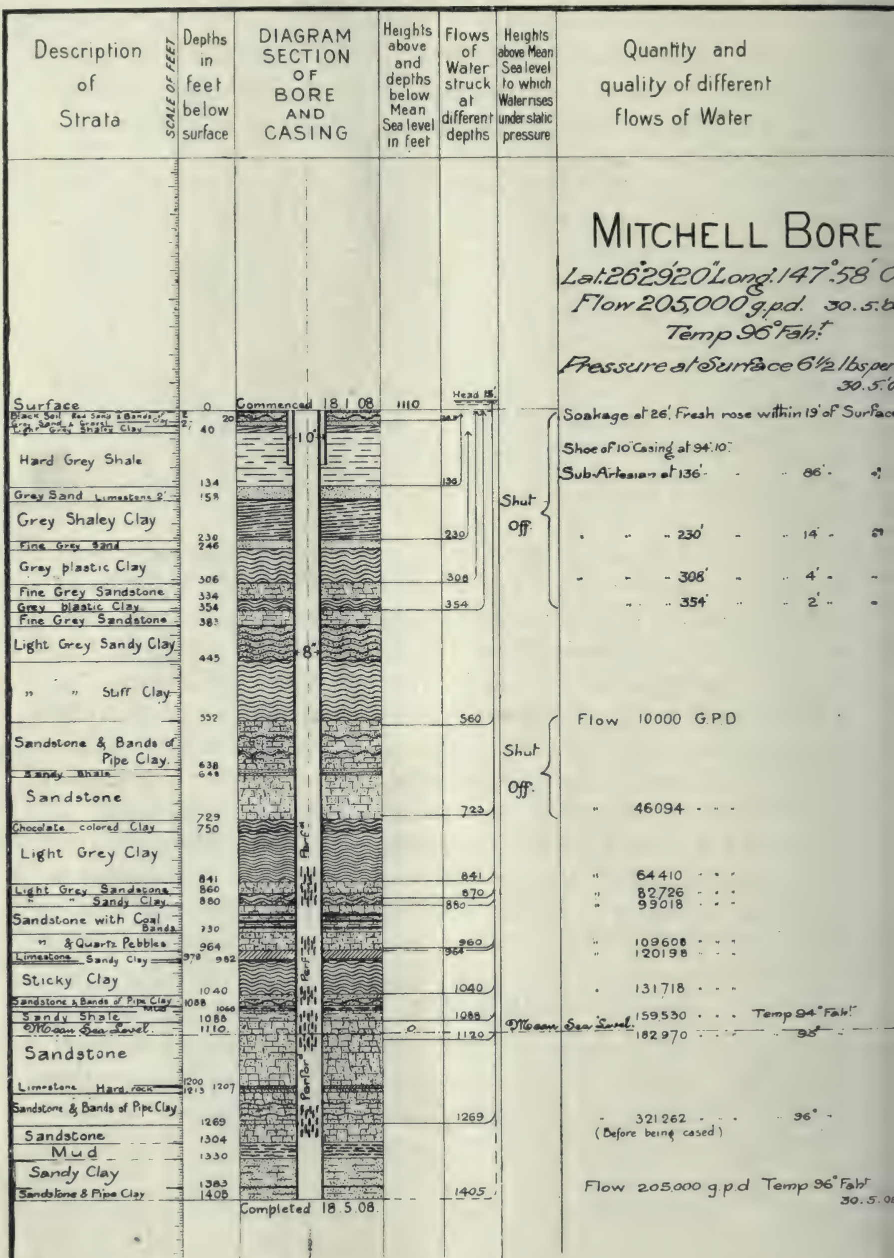
The simple artesian theory and the practical policy founded on it have therefore gone; but the term "artesian" has been continued with a different meaning. According to the preliminary "Definition of terms" adopted by the Interstate Commission of 1912, "artesian water is subject to a natural pressure sufficient to force it above the surface."

According to this "definition," all geysers, springs, and soaks are artesian, because in each of them water, under the influence of natural pressure, discharges at the surface. This is a very different use of the term "artesian" from that in which it was applied to these Australian wells. It was introduced in its original sense for wells in which the "water is under a head dependent on the altitude of the intake bed." The term "artesian," according to the explanation of the Interstate Commission, includes so much that it is meaningless, for, according to it, all flowing wells and springs would be artesian; and if the term "artesian" in the Rights in Water Act be interpreted according to the definition of the Interstate Commission, all the spring water in the State would fall under the restrictions placed on artesian water.

The United States Geological Survey still uses the term in its original meaning; but as the word is used in commercial practice for all wells which have been bored in contradistinction to wells which have been dug, so for the sake of convenience I will use the terms "artesian" and "artesian basin" as they are currently used in this country.

THE INFLUENCE OF GAS AND ROCK PRESSURE.

The explanation of the rise of the water in these wells has also undergone a fundamental change; when I suggested that gas-pressure was an important factor that view was emphatically



Description of Strata
SCALE OF FEET
Depths in feet below surface
DIAGRAM SECTION OF BORE AND CASING
Heights above and depths below Mean Sea level in feet
Flows of Water struck at different depths
Heights above Mean Sea level to which Water rises under static pressure
Quantity and quality of different flows of Water
MITCHELL BORE
Lat. 26°29'20" Long. 147°58'
Flow 205,000 g.p.d. 30.5.
Temp 96° Fah.t
Pressure at Surface 6½ lbs per
30.5.
Surface
0
Commenced 18.1.08
1110
Head 15'
Black Soil
Red Sand & Bands of Clay
Grey Sand & Gravel
Light Grey Shaley Clay
20
40
10"
Soakage at 26'. Fresh rose within 19' of Surface
Shoe of 10" Casing at 94'.10"
Hard Grey Shale
134
Sub-Artesian at 136'
86'
136
Grey Sand Limestone 2'
158
Grey Shaley Clay
Shut Off
230
246
230
14'
Fine Grey Sand
Grey plastic Clay
306
308
4'
Fine Grey Sandstone
334
Grey plastic Clay
354
354
2'
Fine Grey Sandstone
383
Light Grey Sandy Clay
445
8"
" " Stiff Clay
552
560
Flow 10000 G.P.D
Sandstone & Bands of Pipe Clay.
638
644
Sandy Shale
Shut Off
Sandstone
729
723
46094
Chocolate colored Clay
750
Light Grey Clay
841
841
64410
Light Grey Sandstone
860
870
82726
" Sandy Clay
880
880
99018
Sandstone with Coal Bands
930
960
109608
" & Quartz Pebbles
964
964
120198
Limestone Sandy Clay
978
982
Sticky Clay
1040
1040
131718
Sandstone & Bands of Pipe Clay
1088
Mud
1066
Sandy Shale
1088
1088
159530
Temp 94° Fah.t
Mean Sea Level.
1110.
0
1120
Mean Sea Level.
182970
95
Sandstone
Limestone Hard rock
1200
1213
1207
Sandstone & Bands of Pipe Clay
1269
1269
321262
96°
(Before being cased)
Sandstone
1304
Mud
1330
Sandy Clay
1383
Sandstone & Pipe Clay
1408
1405
Completed 18.5.08.
Flow 205.000 g.p.d Temp 96° Fah.t
30.5.

rejected, but gas-pressure is now admitted as one of the contributing factors. The Interstate Commission concludes that the gases "must undoubtedly to some extent assist in bringing the water to the surface." It also recognises that the amount of gas in new bores is larger than in old bores; and this fact may explain that frequent diminution in the discharge from the wells. The Commission, however, still holds that the rise of the water is due mainly to hydraulic pressure, and that gas-pressure contributes only to a slight extent. What the extent is we are not told. Professor David accepts the gas-pressure as a "very material" influence in the flow, and he has recently repeated that gas-pressure "is very important in helping to force artesian supplies to the surface."

The uplift by the expanding gases is probably aided by the heavy pressure of the overlying rocks. The action of the rock-pressure has been denied. The evidence for it seems convincing. As a test case, consider the Kynuna wells. In one bore there the water came from twenty-two layers of sandstone which lay between thick masses of clay. The water from the top bed rose 40 feet, from the second it rose 80 feet, from the third 120 feet, from the fourth 360 feet, from the fifth 560 feet, and so on. From each succeeding layer the water rose higher until at length it overflowed at the surface; from the depth of 2,179 feet it rose 2,246 feet. The obvious explanation of these facts is that the deepest waters rise the highest because they are under the heaviest rock-pressure. These Kynuna wells have a life of from five to seven years; they then fail because the surplus water has been squeezed out of the beds. A section through the area shows that the supposed intake beds, 120 miles away, are lower than the level to which the water rises at Kynuna. If the ascent of the waters were due to water-pressure the upper beds should derive their water from a lower intake than the deeper beds, and this supposition is inconsistent with the actual levels of the country.

Other wells show the same relations of depth and pressure. Thus, the Mitchell bore receives seventeen flows, and the Coorabulka No. 6 has six, and in both there is the same increase in the uplift of the water with the increase of rock-pressure upon it.

THE ORIGIN OF THE WATER.

There has been also a marked change of opinion as to the origin of the water. At first it was all claimed as rain-water; the plutonic origin of any part of it was summarily dismissed. It is well to repeat

Map of Australia showing the main fault and fold lines also the newer volcanic rocks of eastern Australia. Faults are indicated by F. (after David.)

that I did not claim all the water as of deep-seated or plutonic origin; it is, I think, derived from four different sources—

1. Rain-water which percolates underground along the exposed edge of the basin:
2. Water which was included in the beds during their formation and has been stored up in them, as in a closed cistern, ever since; this water of "cisternage," as it is generally called, Professor Walther has recently happily described as "fossil-water":
3. A further supply of fossil-water probably soaked into these beds at an earlier geological period, when the Queensland watershed was further to the east and there was a much greater discharge of rain west into the central basin:
4. Last, but not least in influence, is plutonic water which rises from the interior of the earth. Numerous hot springs, and the ruins of volcanoes of comparatively recent geological date, occur around the artesian area. The adjacent country is traversed by numerous recent fractures, which have had a profound influence on the topography of Eastern Australia; and it is the rule for hot springs to occur only at such fractures. It would be passing strange if none of these fractures have affected the artesian area, since some of the earth movements were certainly later than the depositions of the clays which cover the water-bearing beds; and a map kindly prepared by Dr. Richards shows that some of these faults strike toward the area. Hence it is very probable that hot waters do rise from beneath the earth and enter the permeable beds and there accumulate until the pressure is sufficient to prevent the entry of any more water; and if a bore be put down to the water-beds, then the influence of this plutonic water forces the mixed waters to the surface.

What percentage of water in these beds is plutonic cannot be satisfactorily determined. Mr. Symmonds has estimated the amount as 80 per cent., which is much higher than my estimate. The bulk of the water seems to me water of cisternage, and the energy of the plutonic water is probably more important than its quantity. But instead of the further evidence inducing me to reduce my estimates

as to the quantity of the plutonic water, I believe the amount is greater than I at first thought. The new facts collected during the past eight years have, it appears to me, steadily reduced the proportion that should be attributed to the rain, and increased the proportion of plutonic water.

The existence of this deep-seated or plutonic water is demonstrated by various evidence. The temperature of the water is far higher than it should be for the depths whence it comes. The heat of the water and the variations in its temperature are generally admitted to be inexplicable by the old theory. Thus Dr. Jack,* in 1892, remarked that the temperature of some of the artesian water was surprisingly high, and said that "the depth at which it has been struck is in no case great enough to account for it." He showed that the temperature of the water obtained from the depth of 1,663 feet should not have been reached, even on a geothermic gradient if of 1 degree for 50 feet, till the depth of 2,450 feet; and the later evidence has strengthened this conclusion.

A second series of arguments come from the chemical composition of the waters. That of the artesian waters of New South Wales is known from a valuable series of analyses made in the Laboratory of the Mines Department of that State by Messrs. Mingaye and White. The list includes analyses for 288 wells, and it shows that boric acid is widely distributed in these waters; it is reported at present in ninety-nine of the analyses and as absent from only 47. The quantity is, of course, not large; it is recorded as a minute or small trace in 17; as a trace in 68; as a strong trace in 9; and as giving a strong reaction in 4.

Now boric acid is the most characteristic constituent of deep-seated or plutonic waters. I know of no case of any such wide-spread distribution of boric acid in meteoric waters. The inference from the presence of the boric acid is supported by that of the distribution of chlorine. Chlorine is found in all surface waters, and its absence from certain springs is regarded as clear proof of their deep-seated origin. The shallow waters of Queensland are often rich in chlorine, but in some of the deeper well waters its amount is very low. In the series of analyses by Messrs. Mingaye and White 41 out of the 288 contain less than 3 grains of sodium chloride to the gallon. Some especially significant analyses show that the deeper waters contain less salt than the upper waters.

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* In Jack and Etheridge, Geol. and Pal., Queensland, 1892, p. 416.

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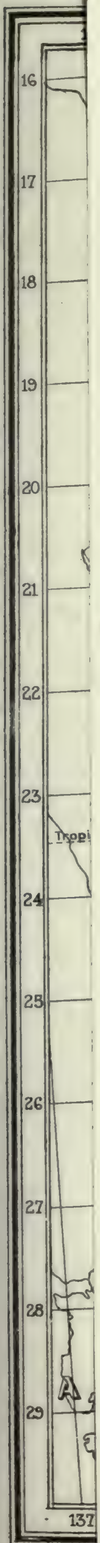


Thus at Cherrigorang an analysis made in 1907 of the upper waters showed the presence of 7·156 grains of sodium chloride to the gallon.

Analyses in 1910 showed the decrease of salt with depth as follows:—

Depth in feet.		Grs.
1,558	..	3,561
2,030	..	1,575
2,062	..	1,575

Again, at Quambone No. 1, an analyses of the upper waters in 1901 showed the presence of 7·099 grains to the gallon. The amount in the lower waters (1910) is as follows:—

Depth in feet.		Grs. to gallon.
1,619	..	2,967
1,760	..	2,008
2,I35	..	1,438

Mr. Symmonds states* that "the chlorine content of the water diminishes with the increase of depth in each bore examined."

The poverty of the deeper waters in sodium chloride indicates that they contain a contribution of water low in chlorine. If the water be rain-water which has percolated down from the surface, then, as the deep waters would have passed the most rock, they should be the saltest. The low salinity of the deeper waters is most easily explained by the assumption that they are plutonic waters which have worked their way upward and have gradually become salter by mixture with the salter surface waters.

It is, of course, true that many volcanic waters contain chlorine; so the presence of some chlorine in a water is no proof either way. But as some plutonic waters are free from chlorine and no meteoric waters are, its rarity in some of the deeper waters supports Mr. Symmonds's conclusion that "their low chlorine content indicates a magmatic rather than a meteoric source of supply."

The gases in these waters are consistent with the inclusion of a plutonic constitutent in the water. The most abundant gas is nitrogen, and nitrogen is given off abundantly from many volcanic fumaroles, as from Etna; and it has recently been proved to be sometimes a plutonic product, since Day and Sheppard have shown that the nitrogen given off from the gas-vents of Hawaii is free from argon, and is therefore clearly not atmospheric nitrogen. Whether the gases from the Australian wells contain argon or not

* W. S. Symmonds, "Our Artesian Waters," 1912, p. 33.

is unknown. The determination of this fact and also the presence or absence of helium would both be useful. The presence of argon would, however, not prove that the gas is atmospheric in origin unless the proportion of argon to nitrogen be the same as in the air. The absence of argon would prove the gas to be of plutonic origin; and if the amount of argon be lower than in the air, then, except on the improbable assumption that all argon is atmospheric in origin, some plutonic nitrogen must be mixed with atmospheric nitrogen, which was derived from air that had been included in the beds during their deposition.

The evidence from the high temperature of the water, its chemical composition, and its irregular variations in composition, all indicate that the water which escapes from these wells is of mixed origin, and that part of it is deep-seated water which has worked its way upward from the interior of the earth. Professor David remarks "that springs connected with faults supply part of the artesian water is obvious," so that though he may differ as to the exact amount and influence of the plutonic water he regards its presence as obvious.

The accumulating chemical evidence is therefore in favour of the plutonic origin of part of the artesian water. And the introduction of this heated water from below explains the abnormally high temperature of the water from these wells.

While that theory has been steadily losing ground in Australia, the trend of European and American opinion on this question has been strongly against its two main premises. Eight years ago the view was held by many authorities that all well-water is derived from the rain; but that hypothesis has been generally abandoned. The fact that vast quantities of water are being raised from the interior of the earth through springs has gained almost universal acceptance; and at present many geologists are inclined to accept probably exaggerated estimates of the amount of plutonic water added every year to the surface of the earth. Moreover, eight years ago orthodox opinion held that rain-water could work its way to great depths below the surface; but the physical difficulties in that process, and the invalidity of the experiments that were thought to prove it are now being more clearly recognised. Most authorities on water supply now agree that only under exceptional conditions and to a limited extent can the surface waters descend 2,000 feet below ground. Thus a recent letter from Dr. G. F. Becker, an

eminent American authority on this question, remarks that in the experience of himself and his colleagues "meteoric waters are very seldom indeed found penetrating over 2,000 feet from the surface." The belief that the deep central basin of Queensland is being constantly recharged with rain-water rests on conceptions of the circulation of subterranean water which are now out of date.

The evidence which I have endeavoured to summarise has led to the recession in Australia of the once universally adopted water-pressure theory. For instance, Dr. Jensen, the Government Geologist of the Northern Territory, declares that "the only conclusion is that the meteoric theory is insufficient to explain facts as we know them. The so-called plutonic theory can and does explain all the facts." Professor David, a leading founder of the water-pressure theory, in the recent Federal Handbook (1914, p. 281), admits that that theory is unproved. He says "the whole physics, chemistry, and geology of the great artesian basin still awaits solution." The latest expression of opinion is by Dr. Sussmilch, in the new edition of his "Geology of New South Wales." He suspends judgment, but remarks (p. 172): "Professor Gregory's theory has not yet been accepted generally by Australian geologists, but he has certainly made out a very strong case."

I find that during the last few years the opinion has been spreading widely among chemists, engineers, pastoralists, and men engaged in the practical administration of the country that the facts are inexplicable on the water-pressure theory.

THE PROBABLE DURATION OF THE WELLS.

These complex theoretical questions are important from their bearing on the probable duration of these wells. The pressure and discharge of the wells have both fallen seriously. During the past fifteen years the discharge from the 124 Queensland flowing wells which have been remeasured has fallen 40 per cent. In New South Wales the fall in yield has decreased 38 per cent. in ten years. Many wells have ceased to flow, and in the still flowing wells the pressure has decreased one-third in the last five years; and the rate of decrease is accelerating. In the face of such facts there can be no difference of opinion that needless waste of these waters should be stopped. Jack and Henderson long ago issued warnings of the danger of waste; but their fears were dismissed as idle by the

upholders of the water-pressure theory, who held that the fall in yield was due to drought, and occurred only on the margin of the basin. The map I published to refute these explanations has been now fully confirmed by that of Queensland issued with the report of the Interstate Commission. It was further maintained that the discharge for all the bores was so insignificant in comparison to the annual intake that the control of the bore was unnecessary. In 1906 I issued an emphatic warning that it would be unsafe to rely on the renewal of the water, as the wells were discharging an old accumulation which could only be slowly if at all renewed; and the Interstate Commission has adopted that conclusion. The national policy in regard to the wells must depend on whether the now well-proved decrease of the water be due to the partial choking of the wells and loss of water by its escape around the casing into porous beds, or whether it be due to a general decrease in the subterranean supply of water and loss of power in the agencies which raise it to the surface.

It is sometimes said that the fall in yield may be simply explained by the wells being too crowded, but the facts do not support that explanation. The fall in yield is not only widespread, but it is very irregular in distribution. A map published by the Interstate Commission in 1912 shows that the fall is not connected with the crowding of the wells. For instance, around and to the north of Cunnamulla many wells have ceased to flow, though others which discharge at the same height (620 feet at Cunnamulla, 621 feet at No. 435 at Woolamurra), and others in more crowded groups as in the Thuralgoona district are still flowing. The failure in this area is not due to differences in height of the mouth of wells, as those on the Desert Sandstone ridge to the west of Cunnamulla are still represented as flowing. Again, the same map shows that the crowded wells around Barcaldine are still flowing, whereas along one band in which the wells are less numerous they have ceased to flow, and some isolated wells have ceased although they are surrounded by others which still flow.

In the area between Richmond and Cloncurry it may appear at first sight that it is the marginal wells which are failing, since those near Saxby on the north-eastern margin have stopped; but further within the basin those at Manfred Downs are flowing, while further west wells at still lower surface levels, as No. 242 on the Marchant River, have ceased to flow.

The diminished flow of the wells cannot be explained by the crowding of wells, and their failure is not limited to those near the margin of the basin or situated at high levels. The irregular distribution of the failing wells shows that the failure is due to some cause which acts sporadically, and is not a universal cause such as water-pressure from a high-level intake. The exhaustion of the water in the high-level reservoir of a town supply would first affect the flow in the upper stories of the houses. If all the houses in one row suffered an equal loss of pressure, the probable cause would be diminution in the main supply; but if the pressure varied irregularly from house to house the fault would be with the pipes in the houses and not with the reservoir. If the hot-water supply varied irregularly in temperatures and quantity, the fault would probably be in the boilers in the different houses; and the variations in the temperatures and yields of the Queensland wells show that there is some influence at work analogous to that which forces hot water to the upper stories in our domestic water supplies.

Two rival explanations of the decrease in yield have been advanced. According to the explanation adopted by the Interstate Commission in 1912, the decrease is due to a progressive loss of head; and in accordance with its recommendations a law and regulations have been passed to stop waste and determine the rate at which the supply is failing. According to the other explanation, the decrease in yield is due to the choking of the wells and the loss of water around them; and the proposals to test the pressure would be mischievous, as it would injure and perhaps be fatal to the wells tested. The controversy turns largely on matters of fact. I have been shown correspondence which shows that there is a very widespread belief among your pastoralists and engineers that closing the wells to determine the pressure is a very dangerous proceeding. They object to the process as much as an invalid would if his doctor proposed to stifle him on the chance that the subsequent *post-mortem* might determine the real nature of his malady. On the other hand it is claimed that wells have been closed for testing without any ill effects. The evidence is so conflicting that it is difficult to decide which view is correct. That some wells might be ruined by stopping them seems to me almost certain. If the casing be badly corroded, stopping the flow through it would probably lead to the escape of the water through the pipe. The measurement of the static pressure would be erroneous, and it might ruin the bore.

How far this danger would outweigh the advantages is an engineering question, and is therefore not in my province; but the danger is not to be lightly dismissed. Mr. Symmonds has published a list of over twenty bores in New South Wales which shows, he thinks conclusively, that the decrease in the yield and pressure is due to escape of water around the casing. There is similar evidence from this State. One way of testing the question is to put down a new bore beside the old one, and if the fall in yield is due to general loss of head, the new bores should not give the original yield of the old bore. In some cases, as at Pela, in New South Wales, new bores give a far smaller yield than the earlier bores; but there are many records of the opposite experience. Thus Mr. Symmonds has quoted the case of the two Coonamble bores, which are 37 yards apart; when the second bore reached the water-bearing bed at the depth of 1,302 feet the total flow from the two bores was more than double the amount which previously came up No. 1 bore. Mr. Symmonds concludes from this fact that "the decrease is largely, in fact very largely, due to the water escaping outside the case and mechanically forming channels." Some cases of interference between adjacent bores are known to occur; thus, when the Youngerrina bore is closed the mud-springs 150 yards away begin to flow; and as these are on the margin of the artesian area their continued flow indicates that the lessened yield of some of the wells is not due to the general lowering of the hydraulic head; for, as Mr. Symmonds remarks, these springs "would be the first to cease flowing if it were a question of lowering the hydraulic head" (p. 17).

In spite of the evidence in favour of the loss of yield by corrosion of the casing and of loss of water around the bores, I still consider that these causes do not explain all the cases, but that the loss is due to a reduction in the accumulation of subterranean water. I therefore feel much sympathy, both with the political authorities, whose duty it is to safeguard the future, and with the pastoralists, who are responsible for the property of the greatest of Queensland's industries. It seems, however, quite possible to reconcile these conflicting policies. The first thing is to determine how far taking the pressure is serious danger, and under what conditions this test should and should not be applied. With some wells it is admittedly safe, and with others it is admittedly dangerous; and in the latter case the information desired should be deduced from the measurement of the discharge, which involves no danger. A commission

representing the pastoralists, hydraulic engineers, the Government departments concerned, and an independent geologist could soon sift the available evidence, determine the actual facts, and frame a series of regulations that would allay the present fears of the well-owners and give the authorities all the information necessary to safeguard this great national asset.

Further careful study of this question is necessary, and unnecessary waste of water should certainly be avoided. As I wrote in 1906, "Whether the wells are flowing under the pressure of far-distant water or under the local pressure of the overlying rocks and of dissolved gases does not affect this question. They are the artificial outlets from a vast reservoir in which the waters have collected during the course of centuries and probably of past millenniums. . . . To allow these deep well-waters, in obedience to a mistaken analogy as to their origin, to run heedlessly to waste is a policy of which a later generation of Australians may have bitter cause for complaint." My chief regret, on looking back over the discussion of the past eight years, is that my conclusion that this water is an old accumulation and is not perennially renewed has been so fully confirmed. If my fears as to its quantity had been dispelled no one would have been more pleased than myself. But the facts have shown that the supply is shrinking with deplorable rapidity; and in face of this process I would renew the warning—guard faithfully the safety of these wells.

I am glad to think that my warning of 1906 has helped to the adoption of measures which may give these flowing wells a longer life than otherwise they might have had.

INTRODUCTION OF PROFESSOR GREGORY.

Before the delivery of the address, the Hon. W. F. TAYLOR, M.D., M.L.C., Vice-President, said: I have to apologise for the absence to-night of the Hon. J. W. Blair, President of the Royal Geographical Society of Queensland. Unfortunately, he is not well and could not possibly get here. His Excellency the Lieutenant-Governor has also been unable to attend; as also Hon. W. H. Barnes. This is our second monthly meeting this session. Our chief business is to listen to an address by Professor Gregory, F.R.S. (Eng.), D.Sc., &c., who was formerly Professor of Geology in the University of Melbourne, and who at the present time is Professor of Geology in the University of Glasgow. Professor Gregory is a gentleman of great eminence in his particular branch of science, and he has the distinction of being a Fellow of the Royal Society of England. Now a Fellow of the Royal Society of England must be a gentleman who has made some original discoveries, and Professor Gregory

has gone into the region of original research with such success as to qualify himself for that very high and distinguished position—the highest position that a man of science can attain to. We are to receive some of the benefits of his original research this evening. Professor Gregory is also the author of certain works bearing upon this subject. Among these are works on the Flowing Wells of Central Australia, and The Dead Heart of Australia, and he is a leading contributor to the literature of the Royal Geographical Society of England and many other scientific societies. I think we are very much honoured indeed by having him with us to-night; and I think we are very much indebted to him also for giving us the result of his researches into the artesian system of water supply in Queensland. This is a question which has many important bearings for us, and there are many different opinions concerning it. Therefore the opinion of so eminent a person as Professor Gregory will be one that will carry great weight. The Professor will speak from actual experience, not from theory as so many of us have to speak. He will tell us what he has seen and what he knows, and, therefore, what he tells us to-night we may take as proof that such and such is the case. I have much pleasure in asking him to be kind enough now to deliver his address.

After the delivery of the address, the Hon. Dr. Taylor said: We have had a very interesting paper, and Professor Gregory has given us a good many things to think about. I think we are very much indebted to him, and I would ask the Hon. Mr. Brentnall to move a vote of thanks.

Hon. F. T. Brentnall, M.L.C., said: We have had addresses and papers and essays of various kinds, but we have seldom been favoured with an address so strongly scientific, given by an expert in his own particular department of science, as that to which we have listened this evening. I am sure that all of us feel greatly indebted to Professor Gregory for his kindness in affording us such an amount of consideration and information on a subject which is vital to the interests of this State. I am not going to attempt to enlarge upon the subject. It would be presumption on my part to do so, because, in the first place I do not profess to have studied science very much, or the particular branch of science to which our attention has been drawn this evening, and in the second place there are gentlemen present who have had a great deal more practical experience of this source of water supply than I have had an opportunity of gaining. For this reason I am sorry that the duty which has now devolved upon me has not fallen to some gentleman more acquainted with the subject. One thing I am quite confident about, and that is that those gentlemen who are interested specially in this department of science—in the continuance of the artesian supplies of water and in the provision for supplying water in the dry regions of this continent, and especially of our State—and the members of the Royal Geographical Society will feel deeply thankful to Professor Gregory for the information which he has given us. Looking at the matter altogether apart from the technical aspects of the question, and simply at its practical and economic aspects, I feel justified in proposing that a very hearty and sincere vote of thanks be accorded to Professor Gregory for the very instructive essay which he has delivered to us this evening.

Hon. A. H. Whittingham, M.L.C., said: It gives me great pleasure to

second the vote of thanks which has been moved by the Hon. Mr. Brentnall. I consider myself fortunate in having heard Professor Gregory's interesting and able discussion of the artesian water system. It is a subject of great interest to us all, and to pastoralists in particular. It is also one which during the last year or so has caused a certain amount of friction between the pastoralists and the Hydraulic Department. I do not wish to go into details about that just now. The chief point we have been at variance about has been the advisability or not of checking the pressure of these bores. I was very pleased to hear Professor Gregory say to-night—and it is quite true—that to certain bores it does no harm, but with other bores it would be a most serious matter—in fact, so serious that some pastoralists would not allow even the Government department to touch their bores. I have a bore on my own property that has been flowing for twenty-six years, and I would like to see any Government department come along to test that bore. I would not allow it to be done, because there is no telling the state of the casing of a bore that has been down so many years. That bore was sunk in 1888, and it is yielding something like three-quarters of a million gallons a day. It is flowing now and watering more country than it ever did since it was sunk. Professor Gregory suggested the appointment of a commission consisting of a pastoralist member, a member of the Hydraulic Department, a geologist, and one or two others to go round and investigate this matter. We would be thoroughly in accord with that. We have lately had a commission in Brisbane investigating this matter, and I do not mind saying that they were theorists and not practical people. It was a misfortune to give evidence before them, and as soon as I went into the room I could see very plainly that they were more or less prejudiced. They had certain theories. Professor Gregory has his theory, and there are many others who have theirs. Mr. Pittman has his theory of the artesian water supply, and Mr. Pittman was chairman of that commission, and I think he could not get out of his head that that was the only right theory. We have heard different to-night. I do not wish to go into the matter now. I have much pleasure in seconding and supporting the motion moved by Mr. Brentnall.

The motion was carried by acclamation.

RESOLUTIONS BY THE SOCIETY.

Dr. J. P. THOMSON: I think it will be admitted by the members of this Society generally, and more especially by all who have had the privilege of hearing Professor Gregory to-night, that the address to which we have listened with so much interest and pleasure has in itself fully justified the visit of the British Association to this country, and we may congratulate ourselves on the success of the meeting, which will be regarded as one of the most important events in the history of our activities. It is well known to the earlier members of the Society that we have for many years been interested in the subject of the artesian water supply. Going back for some twenty years or more—as Professor Gregory remarked in the opening words of his address—the duty devolved upon this Society, mainly through myself, of challenging the submarine leakage theory of artesian water, so persistently postulated by Dr. R. L. Jack and other Australian geologists. The challenge, it is gratifying

to say, was successful, and for a long time now the leakage theory has been dead, its advocates being discreetly silent, although some have been honest enough to actually acknowledge defeat. It should be remembered that the theories now advocated—that is, the meteoric theory of one school and the plutonic theory of another, especially the former—are identical with the theories of origin put up by geologists some twenty years ago, there being little modification in the views favouring either one or the other. I think one of the strongest points in favour of the plutonic theory is that stated by Professor Gregory himself—that in the very large majority of the investigations made as to the source of artesian supplies, it has been shown conclusively that the rain-water does not descend below the surface to a much greater extent than 2,000 feet. That to my mind is strong evidence in support of the plutonic theory. We then have to consider the immense extent of the intake rocks and water-bearing beds of the Lower Cretaceous formation, stretching from Dubbo in the south to the Gulf of Carpentaria in the north—about 1,100 miles—and from east to west over 1,000 miles. It is an enormous area, and to assume for one moment that the geological and physical conditions are continuous and uniform throughout would seem highly improbable. It would, indeed, seem to me remarkable that the water-bearing beds should be continued for the enormous distance of 1,100 miles north and south and over 1,000 miles east and west without any break in their continuity. I had the opportunity of personally inspecting the whole of the country under reference many years ago, when professionally engaged on fieldwork in New South Wales and later in Queensland, in association with the late Sir A. C. Gregory. I can therefore claim to have some intimate knowledge of the physical conditions and geological structure of the area in question, which enables me to support the lecturer. It has been considered by the officers of this Society that the Society should not remain silent in a case of this kind, and having had the benefit this evening of Professor Gregory's views, some action should be taken by the Society to mark its approval or disapproval of the views which he has so ably advocated. I accordingly move—

"That this Society, after hearing Professor J. W. Gregory's luminous address, is of opinion that too much reliance should not be placed on the theories publicly enunciated by the Interstate Conference on Artesian Water—

1. That the water of the Great Australian Basin is almost wholly, if not entirely, derived from rainfall, and

2. That the rise of the water is primarily due to hydraulic pressure—

   (*a*) Because the areas, location, and porosity of the so-called intake beds have not been sufficiently investigated to justify the hypothesis that the supply is almost wholly, if not entirely, derived from rainfall;

   (*b*) Because the rise of the water can be accounted for equally as well, if not better, by the undeniable facts of gas and of rock pressure, as by the theory of hydraulic pressure; and

(*c*) That the observed diminution in flow has not been proved to be due only to the lowering of the hydraulic head, or, in other words, to the depletion or diminution of the supply, but may and most probably is due to other causes, including rock compression at the seats of flowing wells, thus hindering or retarding the flow of water into the wells; the escape of water into beds beside the wells; and the choking of the inlets to the bores.

That the value of the water supply and importance of making same available to the utmost limit practicable without waste, would justify the appointment of a Commission having powers similar to those of the Land Court, such Commission to be entirely independent of departmental influence and control.''

Mr. PHILLIPS said he was in complete accord with and pleased to second the resolutions moved by Dr. Thomson. The hour was late, but he would like to offer a few remarks on certain conclusions arrived at by the Interstate Conference on Artesian Water, the chief of which were—(1) The water is almost wholly, if not entirely, derived from rainfall; (2) The rise of the water is primarily due to hydraulic pressure. When he gave evidence before the Conference in Brisbane, on 3rd July, the Chairman, Mr. Pittman, inquired if he would be surprised to hear that the yield of the flowing wells is decreasing on an average at the rate of 8 per cent. per annum. Bearing these things in mind—(*a*) that the water is derived from rainfall, (*b*) that it rises under hydraulic pressure, (*c*) that the yield is rapidly decreasing, and (*d*) that the years 1903-1914 have been years of exceptionally good rainfall—more especially in the West—then it appeared to him that the only logical deduction from the premises is that artesian wells in Queensland are doomed to early extinction, and that it should be the immediate duty of the Government to summarily close down at least 25 per cent. of the wells and strictly limit the output of the remainder. As regards the source of the water, Mr. Phillips said, little is really known. It had been an article of faith with him for many years that if the source is meteoric, then the intake beds are represented by the Blythesdale Braystone series of rocks, in accordance with Dr. Jack's views. But Professor Gregory had that night assured them that the Blythesdale Braystone is not a porous rock, and therefore could not be the conduit of rain-water from the surface to the vast underground reservoirs. Geologists are now pinning their faith on the Jurassic beds, one of the three divisions of the Mesozoic rocks, but the Professor predicted a shorter life for this than for the Braystone theory. Some twenty years ago the Hydraulic Engineer estimated the width of the intake beds at 10 chains or one-eighth of a mile. Later, Dr. Jack said 5 miles, and subsequently increased his estimate to a width of 55 miles by a continuous length of 1,000 miles of Blythesdale Braystone; but now we are told that rock is not sufficiently pervious, and further that nothing like 55,000 square miles of the rock is to be found in Queensland. It will be seen, therefore, that practically we are completely in the dark as regards the source of the water; all we know is that the water exists and underlies some 375,000 square miles of Western Queensland. Until the areas, location, and porosity of the so-called intake beds are completely and satisfactorily investigated, the meteoric theory of source must be regarded as not proven. We are, however, on safer ground when we contemplate the enormous quantity of water that undoubtedly exists in the vast underground reservoirs

of "Artesia," if he might so name the great Australian artesian basin. These reservoirs, placed deep down in unfathomable mines, where neither sun nor wind can get at them, might easily contain from 1,000 to 2,000 cubic miles of water, according to the mean thickness of the porous strata and the coefficient of porosity. Taking the mean thickness of the beds at 200 feet and the coefficient of porosity as 15 per cent., the quantity of stored water in Queensland would exceed 2,000 cubic miles in volume. Such a vast volume of water could not be exhausted by the existing flowing wells of this State in 6,000 years, and yet we are told that the yield is decreasing at the rate of 8 per cent. per annum after a period of less than thirty years. Whilst Mr. Phillips did not question the accuracy of the statement made by Mr. Pittman that the yield of the flowing wells is seriously decreasing, he thought that the phenomenon is capable of explanation on quite other grounds than the depletion of the supply. It is well known by practical men that well-borers carrying out work by contract do not always sink the tubes to the full depth of the bore. The drilling is always in advance of the casing, and once the water rises to the surface the pastoralist is so pleased that he is not as a rule disposed to be too critical as to the means that brought about so desirable a result. Again, the casing seldom if ever tightly fits the bore, so that more or less and probably increasing quantities of water steadily rise outside the casing, and find their way into dryer porous strata nearer the surface. In some instances in Mr. Phillips' own experience, large quantities of water rise to and flow over the surface outside the casing. It is also well known that the casing often corrodes, so that it affords little if any protection from the sides of the bore caving in and either wholly or partially choking the well. Mr. Phillips thought that the principal reason for the diminished yield would be found to be the compression of the porous rocks at or near the seat of the wells. He stated that at 2,000 feet below the surface (which might be regarded as the mean depth of artesian wells in this State) the pressure of the superincumbent mass would be about one ton (2,240 lb.) per square inch. Whilst this enormous pressure could readily be borne by the porous rocks when fully charged with water and therefore in a state of equilibrium, as soon as the porous stratum is pierced and the water flows upward in response to pressure (due to any cause) then the state of equilibrium is disturbed and the supporting power of the water is diminished in the immediate vicinity of the well, so that the rock is gradually compressed because the water is being squeezed out of it, with the result that less and less water can reach the bottom of the well. On the subject of the distribution and utilisation of artesian water, whilst no doubt it is desirable that waste should be discouraged, there was the practical difficulty under existing conditions of pastoral occupation in large areas, that the cost of distribution over long distances other than by means of natural watercourses or shallow artificial surface drains would be prohibitive. Mr. Phillips instanced his experience in 1896, when he was employed by the Lands Department to report on the best means of supplying water to grazing farms on the resumed areas at Bando and Bundaleer, in the South-Western district. The Hydraulic Department had recommended reticulation from one or more bores by means of cast-iron pipes, but Mr. Phillips found that the pastoralists of that district conveyed bore-water by means of shallow ditches, costing only about £4 per mile. Some of the ditches were 20 miles in length and cost less than £100, whereas a 6-inch pipe line of that

length would have cost at least £30,000, and would involve a lot of attendance to provide water at frequent intervals. It will be seen, therefore, how difficult it is, under existing conditions of pastoral occupation, to properly utilise the water and at the same time obviate what many scientific gentlemen, unacquainted with Western conditions, term "waste." In conclusion, Mr. Phillips said he believed the day would come when a family would be settled on every square mile of "Artesia," when the graziers of that day would regard the grass crop as a hay crop to be taken off with the aid of the mowing machine, and the sheep turned on the stubble. When that time arrived he had no doubt water would be distributed in such a manner as to minimise waste and turn the land to the utmost advantage. The dawn of that day was not yet, but it could not me much longer delayed—probably within the lifetime of the younger portion of his hearers. (Applause.)

In supporting the resolution, Dr. du Toit, Government Geologist of South Africa, alluded to experiments in the porosity of sandstone rocks, which showed conclusively that the passage of water through the rocks was so extremely slow as to render them of no practical value as intake beds.

The resolution was put and carried unanimously.

SOUTH-CENTRAL AFRICA: A NARRATIVE OF PERSONAL TRAVEL AND EXPERIENCES.*

(*With Sketch Maps and Illustrations.*)

An Address delivered to the Royal Geographical Society of Australasia, Queensland, 14th September, 1915, by His Excellency Major Sir Hamilton Goold-Adams, Governor of Queensland, G.C.M.G., C.B., F.R.G.S., &c., &c., President Royal Geographical Society of Australasia, Queensland.

THE SOCIETY'S THIRTIETH ANNIVERSARY.

In June of this year the Royal Geographical Society of Australasia (Queensland) reached the thirtieth anniversary of its foundation. Its career from the date of its inauguration has been one of sustained and uninterrupted interest.

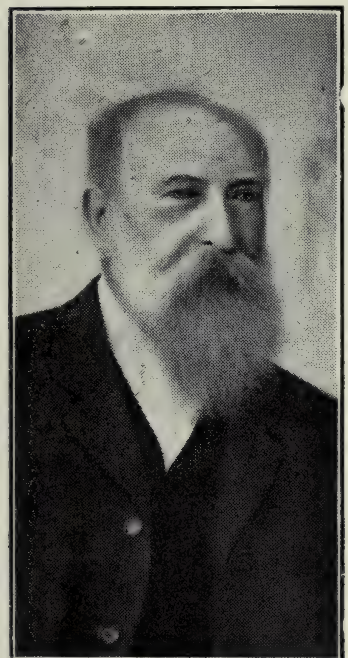
From the very first the society has set up for itself the cardinal principles of universal geography, adopting a broad and comprehensive policy in the acquisition and dissemination of such knowledge as naturally falls within the scope of the department of geographical science, in its widest sense, and understood in the light of the present age. It was early recognised in the direction and management of the affairs of the Society that in a comparatively young country, whose remote territorial areas were even inadequately explored, whose resources were mostly undeveloped, whose local institutions were immature, and whose intellectual life required the stimulating influence of example and precept, that there must be a liberal interpretation of the aims and objects of such an institution. It was felt that to keep abreast of the times, to establish a good reputation at home and abroad, to be of public utility, and to serve the best interests of the State, the old school ideas of geography must be discouraged and the obsolete system of instruction superseded by a new and advanced line of teaching. And this would recognise as its principle a knowledge of the earth and its inhabitants, including man and his environment. The scope was comprehensive enough, embracing, as it did, a wide range of subjects.

HON. SIR A. C. GREGORY, K.C.M.G., F.R.G.S., M.L.C., &c., First President of the Society.

In the inauguration and early pursuit of its work the Society encountered many obstacles, and the impediments which lay in the path of the founder

* [Reprinted from *Truth*, 19th September, 1915.]

were both numerous and formidable. But this was chiefly because there were probably so few who really understood the work, and even now there are many who do not fully understand, or fail to comprehend, what geography means when considered in its broadest sense. This is no doubt in a measure due to circumscribed environment, for local scientific effort is mostly confined to specialised branches of inquiry or investigation, which in the very nature of things has an irresistible tendency to limit the horizon of associated workers and develop parochial ideas and sympathies. Anyway, there has been a great



Rt. Hon. Sir H. M. Nelson, P.C., K.C.M.G., D.C.L., F.R.G.S., Past President.

Dr. J. P. Thomson, LL.D., Hon. F.R.S.G.S. (Edin.), Founder, Past President, Hon. Secretary, and Treasurer.

deal of work accomplished, and, as evidence of the success attained, reference need only be made to the practical results of continuous and undiminished activity during the last thirty years, as well as to the position of equality which the society occupies amongst the scientific and literary institutions of the world. As giving an idea of the comprehensive nature of the Society's operations and the range of subjects treated, it may be noted that of the total number of papers read, printed, and published, generally speaking, 25 per cent. relate to Queensland, over 41 per cent. refer to Australasia, including Tasmania, New Zealand, New Guinea, and the Pacific Islands, 27 per cent. deal with general geographical subjects, and the balance are distributed over Europe, Asia, America, and the South Polar regions. And it is satisfactory

to find that of all the communications which appear in the nearly thirty volumes of the "Proceedings and Transactions," about 80 per cent. are original contributions to geographical literature, the remainder being the result of research work in contradistinction to mere compilations. From this brief analysis it will be seen that the work which the Society has accomplished is practical and substantial.

There has been no interruption in issuing the publications of the Society, which have been sent out regularly from the beginning to public libraries, Government departments, and kindred institutions all the world over. In

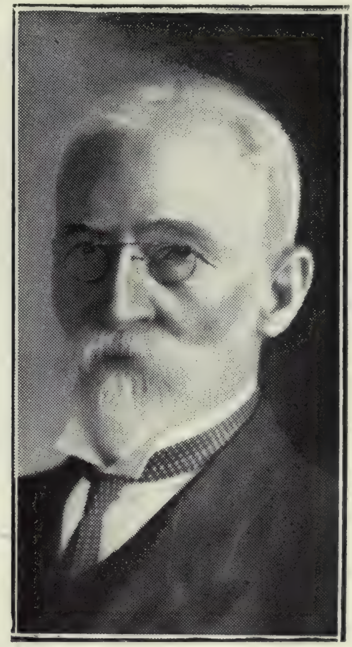
HON. SIR ARTHUR MORGAN,
Kt., F.R.G.S., &c., Past President.

RT. HON. LORD CHELMSFORD,
P.C., G.C.M.G., F.R.G.S.,
Past President.

exchange for these the Society receives a corresponding number of valuable publications, with which the library is enriched. And there is little doubt that this library is the most comprehensive and complete of its kind in Australasia, containing as it does thousands of valuable works, representing every department of science, letters, and arts in all the languages,, besides a great variety of maps and atlases. It is, in point of fact, a storehouse of the choicest literature issued from the intellectual Press of the world, giving expression to the scientific and learned thought of the age, and recording with singular fidelity the entire progress of human knowledge. It is, however, regrettable that this magnificent and locally unique repository is not more

widely and generally utilised. Not alone for purposes of reference is this storehouse available, but it is stocked with entertaining and informing personal narratives of travel, fascinating descriptions of such natural phenomena as have occurred over the entire surface of the globe or even extending to the celestial sphere, and the instructive results of investigations which have been conducted from time to time into the terrestrial floras and faunas, including the life history of the human race and man's place in the economy of Nature. As at present constituted, the Geographical Society is a thoroughly representative and up-to-date institution, in which encouragement is afforded

RT. HON. SIR WM. MACGREGOR, P.C., G.C.M.G., C.B., M.D., LL.D., D.Sc., F.R.G.S., &c., Past President.



RT. HON. SIR S. W. GRIFFITH, P.C., G.C.M.G., M.A., LL.D., &c., Past President.

to all active workers. As a means of communication with the intellectual world at large, it offers greater facilities than any other existing local organisation, its aims being sufficiently comprehensive to cover a very wide and almost unlimited range of inquiry. And in this connection it recognises that while specialised branches of science are necessary to progress, such specialisation can only be regarded "as a phase of a working life and not as the whole purpose of a whole man." As the only local body devoted exclusively to the interests of geography, in its widest sense, the Society recognises no class distinctions, no political shades, and no religious or ethical lines of thought.

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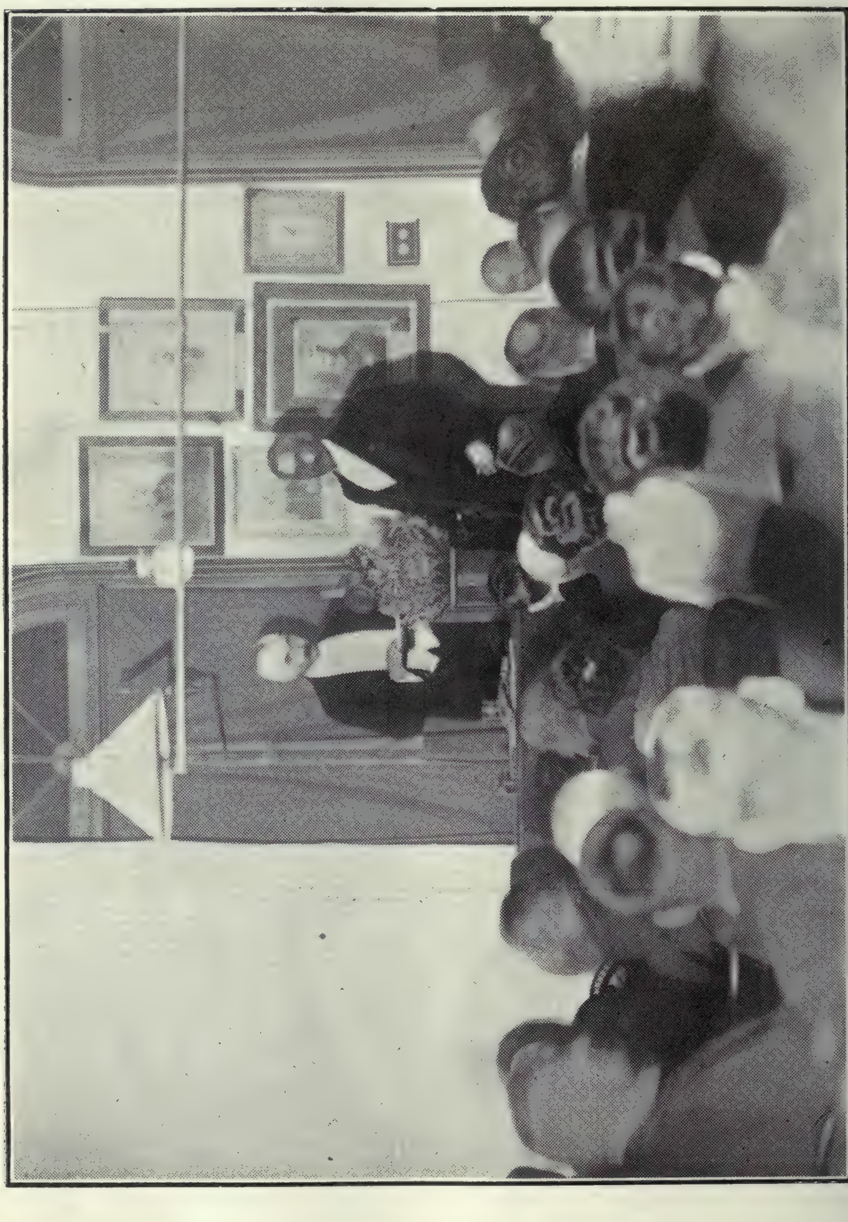


Flash Light Photo. of His Excellency the Governor, taken at the Lecture Hall on

Judged on its merits alone, it has put up a record of good, substantial, honest, practical work, in which the best interests of science and the State of Queensland have been equally served, with fidelity and patriotism.

No reference to the Society, however brief and fragmentary, would be complete without allusion to Dr. J. P. Thomson, its founder.

At the commencement of 1885, Dr. Thomson took active steps to establish the Society. From its foundation up to the present time Dr. Thomson has laboured incessantly in its interest; first for nine years as honorary secretary and treasurer, afterwards for three successive years as president, lastly again as honorary secretary and treasurer, and always editor of its literature. In 1900, under the presidency of Sir Hugh Nelson, it was decided to recognise the valuable and gratuitous services of Dr. Thomson by the establishment of the Thomson Foundation Gold Medal of the Royal Geographical Society of Australasia, and the first medal was awarded by the members of the Society to Dr. Thomson himself for his distinguished services to geographical science, apart from his services to the association.

SOUTH-CENTRAL AFRICA.

THE GOVERNOR'S ADDRESS.

The thirtieth milestone in the annals of the Society will be rendered memorable by a notably interesting contribution by His Excellency the Governor. At the association's rooms on Tuesday evening last,* Major Sir Hamilton Goold-Adams, as President of the Society, delivered an address on "South-Central Africa," which was unique in personal reminiscences and of exceptional geographical interest and historical importance.

As our readers are well aware, the Governor was especially well equipped for his self-selected task. His Excellency possesses a distinguished official career in the service of the Imperial Government. As far back as 1884-5 he served with the Bechuanaland Expedition under Sir Charles Warren, and commanded the field force against the Matabele in 1893. In 1897 Sir Hamilton Goold-Adams was appointed Resident Commissioner of the Bechuanaland Protectorate, from 1901 to 1907 was Lieutenant-Governor of the Orange River Colony, and Governor from 1907 to 1910.

His Excellency, in addressing the members of the Royal Geographical Society, spoke as follows:—

Before entering upon the description of my expedition to South-Central Africa, which I purpose giving this evening, I consider it desirable to briefly explain, with the assistance of the map of South Africa, the circumstances under which certain territorial boundaries, to which I shall have to refer in the course of my lecture, came into existence.

Immediately after the Boer War of 1880, which resulted in Great Britain's acknowledging the semi-independence of the Transvaal Republic, President Kruger set to work to extend the boundaries of that republic to the west and

* September 14, 1915.

LOCALITY MAP OF SOUTH-CENTRAL AFRICA, SHOWING (DARK-SHADED) THE REGION EXPLORED BY

north. His plan of campaign was to allow his burghers to undertake filibustering expeditions into neighbouring native States, with the object of acquiring from the chiefs, by fair means or foul, titles to areas of land; and then, at the request of these same filibusters, to extend the boundary of the republic so as to embrace the lands occupied by them.

Some of the native States on the west realised the danger which threatened, and asked Great Britain to afford them her protection. This request was granted, and, as a consequence, Great Britain, in 1884, sent an expedition, under Sir Charles Warren, into Stellaland and Land Gochen, two self-proclaimed Boer republics, in order to restore the lands to the natives. Great Britain annexed these two young Boer republics and incorporated them into British Bechuanaland, and at the same time declared a protectorate up to the 22 degrees south latitude and as far west as the 20 degrees longitude.

It was then that the town of Mafeking was founded, with the object of creating a centre for British enterprise on the west of the Transvaal, and as a base for further trade into the central regions of Africa. I may say that I had the honour of participating in the function of laying the first foundation stone of the new township.

In the early eighties the European Powers commenced their scramble for the unallocated portions of the continent of Africa, and Germany, having planted her flag on the western coast of South Africa, declared as German territory the whole coast, with the exception of Walfish Bay, from the Cape Colony border on the south to the Portuguese colony of Mossamedes on the north, and also, by virtue of her doctrine of "hinterland," claimed all the country from the coast back to the 20 degrees E. longitude. Germany then proceeded to negotiate with the Portuguese regarding their mutual "hinterland" boundary, it being eventually agreed between them that the line should run from the mouth of the Cuneue River across to the Okovango, thence down that river to Andara's, and thence to the centre of the Katima Molilo rapids on the Zambesi. As a result of this, Great Britain immediately extended her protectorate up to the 18 degrees S. latitude and the 21 Mer. E. longitude, and entered into an agreement with Portugal that their respective spheres of influence in South-Central Africa should provide for the Barotse Kingdom being regarded as British territory, and that the western confines of that kingdom should form the boundary lines between the British and the Portuguese spheres of influence.

In November, 1895, I was sent by the Colonial Office to South Africa to mark out certain areas of the Bechuana Protectorate as reserves for the tribes of certain native chiefs who had visited England for the purpose of having their boundary disputes settled. I arrived in Mafeking twenty-four hours before the Jameson Raid started from that place into the Transvaal. As soon as the consequent excitement had subsided and I was able to get together my wagons and other impedimenta, I started off into the Protectorate to carry out my duties. The Protectorate embraces an area of about 540,000 square miles. On its eastern border, adjoining the Transvaal, the country is hilly, though not mountainous. The population comprises five tribes of Bechuana natives, numbering collectively about 130,000, and as the Government allows no European settlement, the white element consists exclusively of a few traders and Government officials. From this eastern fringe of hilly country

SKETCH MAP, ILLUSTRATING HIS EXCELLENCY'S LECTURE ON "A JOURNEY TO SOUTH-CENTRAL AFRICA"

right across to the German border, and extending the whole way north, is what is known as the Kalahari desert. It has an elevation of about 3,500 feet above the sea, and, except for rolling sand belts which occur at frequent intervals over its whole surface, is practically dead level. Rivers are lacking, save in the North. The surface generally is covered with a coarse grass and a considerable amount of timber—principally acacia, and what is known as "yellow wood." It is important to note that the aspect of the country as seen by travellers is really far removed from what is ordinarily understood by the word "desert." Where water can be obtained, it is most excellent cattle country, and in many parts there are found two or three different varieties of indigenous melons, which provide food and moisture for all classes of animals, as well as for the bushmen. Here and there at intervals the sand seems to have been scooped away, presumably by the wind, and, where the underlying horizontal layer of limestone is thus uncovered, permanent water is found by sinking a few feet into the limestone. A very peculiar feature in respect to this drifting of the sand is the fact that it all seems to have been caused by winds from the north-east, as the sand is always piled up in a huge drift on the south-western side of the depression, yet in the present day the prevailing wind in the Kalahari comes from the north-west.

The Bechuanaland Protectorate is very sparsely populated by three classes of natives—(*a*) the Bechuana, residing on the eastern fringe of the country, to whom I have already referred, who, in consequence of their higher intelligence and generally stronger character, have assumed control of the other two races who occupy the desert country. (*b*) The Bakalahari—or Vaalpens (Yellow Bellies) as the Dutch call them—undoubtedly Bechuanas, but of a very inferior type, presumably one of the earlier waves of that race, who are the servants of the Bechuana proper, and who are usually employed by them as the caretakers of their flocks and herds at the several watering places in the Kalahari. (*c*) The Bushmen, the true aboriginal inhabitants of the country, who have been so frequently described by travellers. In type they differ altogether from either of the two races previously mentioned. They seldom exceed 4 feet 9 inches in height, are of a dirty yellow colour, and have slightly slanting, deeply-set eyes and prominent cheek bones. A hollowed back and a protruding stomach are also frequent characteristics of their figures, yet they are active, and capable of enduring great privations. For clothing the men wear a triangular piece of skin drawn tightly between the legs and fastened round the waist with string, while the women wear a small skin apron and a skin cloak. They are fond of ornaments, and decorate their arms and necks with beads and rings, the latter very often being a section of an entrail from an animal they may have killed. They are nomadic in their habits, and travel in small groups from patch to patch of water melon, follow flights of locusts on their daily travels, or, again, hang on the skirts of migrating herds of game. Famous hunters, they can actually run down many kinds of game, but in spite of this they live a life of periodical starvation, existing in times of stress on such things as lizards, tortoises, mice, snakes, and frogs. For very long periods the moisture they obtain from roots and melons may be their only drink, and I have known families who have had actually to be taught to drink water. Their language is a series of clicks, and is so difficult to acquire that I have found but very few Bakalahari who have mastered it, even though they had been born and brought up amongst the Bushmen.

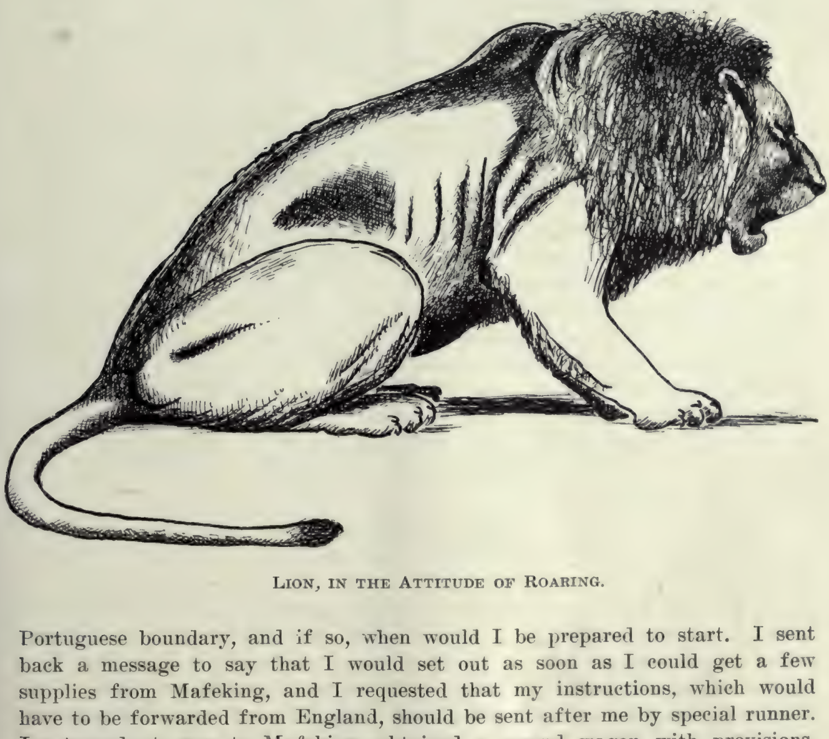
The Bakalahari are, as I have said, the servants of the Bechuana, and, not being permitted by their masters to own property of any description, nothing even which they catch or kill can be claimed as their own. The Bushmen are, in their turn, the servants of the Bakalahari, and when it is added that there is a greater social distinction between the Bakalahari and the Bushmen than between the Bakalahari and their masters, one may get some faint idea of the unenviable social position of the unfortunate Bushmen.

WHITE-TAILED GNU.

In delimiting the boundaries of the native reserves in the Bechuana Protectorate, I had to traverse long stretches of country in the Kalahari, and this necessitated a considerable amount of very arduous travelling. My outfit consisted of one wagon with sixteen oxen and a water-cart, and I was accompanied by an ex-member of the Bechuana police, whose name was Worrall. and by a bastard named Daniel, who could speak English, Dutch, and Sechuana, the language of the Bechuana.

After travelling in this style and performing my duties for three months, I one day received a message from the High Commissioner at Capetown informing me that the British Foreign Office was anxious to know whether I would go at once to Northern Zambesi on an urgent mission in connection with the

LION, SHOWING HOW IT KILLS ITS PREY.



LION, IN THE ATTITUDE OF ROARING.

Portuguese boundary, and if so, when would I be prepared to start. I sent back a message to say that I would set out as soon as I could get a few supplies from Mafeking, and I requested that my instructions, which would have to be forwarded from England, should be sent after me by special runner. I returned at once to Mafeking, obtained a second wagon with provisions, bartering goods for bartering with the Central African tribes, to whom money,

I knew, would be valueless, and engaged the services of ex-Sergeant-Major Cole, of the Bechuana police, to supervise my waggon transport. The first question to be decided was the route by which I was to proceed. There were two possible courses—one along the eastern border, through Khama's country to the Victoria Falls, then across the river, and up the eastern bank of the Zambesi to Lialui, the capital of the Barotse country; this was the recognised route, and under ordinary circumstances would undoubtedly be the right one to take. Unfortunately for me, however, there were two circumstances which made it risky to attempt it. A rebellion was taking place in Matabeleland, along the borders of which country I should have to pass, and rinderpest was making great ravages among game and stock of all classes in the neighbourhood of the Victoria Falls. Thus, even if the first difficulty could have been safely surmounted, there was little chance of my being able to prevent my cattle dying, and thus there was every probability of my being stranded on the road. The other route lay across the Kalahari to Lake Ngami, from which place I should have to pass up the Okovango River and thence into the Barotse country lying to the west of the Zambesi. This route was scarcely known to white persons, and, though people had been up to Lake Ngami, there had only been one white man to my knowledge who had travelled from that place to the Barotse Valley, and consequently I was able to get very little information regarding the difficulties to be encountered. This, however, was the way I decided to take, since a considerable portion of the road was known to me, I should run no risk of interference by the Matabele, and, further, I might escape the rinderpest. Accordingly, early in April, 1896, I started westward in my caravan.

My first destination was Lohututu, 300 miles due west of Mafeking. To get there I had to traverse three long waterless stretches of 87 miles, 74 miles, and 55 miles respectively, in addition to two or three comparatively small ones, each over 30 miles. The track followed was that made by the wagons of the Bechuanas when they occasionally penetrated the desert to collect skins from the Vaalpens. When it was first cut it is impossible to say, but owing to the long, dry stretches and the impossibility of travellers delaying in order to cut the trees and open fresh paths, each wagon followed exactly in the spoor of those which had preceded it in the bygone years. In consequence of this drawback, the sand in many places reached the nave of the wheel. If the trees would allow, good, firm ground could be obtained on either side of the existing track, but the reasons given above forced travellers to adhere to the old sand-clogged trails. It is primarily due to the heavy nature of the roads that such fearsome tales have been spread abroad concerning the heavy sand in the Kalahari.

The same system of traversing long dry stretches of country is adopted in both Australia and South Africa. One must push into the "thirst" a certain distance, send the oxen back to water, and, after bringing them up again, press on as far as possible until one is eventually able to send the cattle ahead to the next water and give them a rest there, whence they must return and pull the waggon out. I happened to be reading the other day, in a rather well-known Australian book, "We of the Never-Never," that in the Northern Territory a 50-mile dry stretch with a loaded wagon is considered the limit for mortal bullocks. In that connection I can only again point out that I negotiated successfully the distances mentioned. One must admit,

however, that these long stages had a very exhausting effect on the cattle, and that after each "thirst" the oxen had to be spelled for ten or twelve days at least.

The native settlement at Lohututu embraces three or four separate native villages at small neighbouring waterholes, the inhabitants, as a rule, being

CENTRAL AFRICAN BUSHMAN.

refugees from justice from Cape Colony. When I visited it, one of the principal men there was a native chief, who had fought against the British in the Griqualand West war of 1878, and who was still wanted for murder. As, however, I had neither the force nor the necessary warrant for this man's arrest, I took no action regarding him.

Lohututu is the only centre of this kind in the desert, and as it is 300 miles from the Cape Colony border, it is a comparatively safe harbourage for blackguards of all descriptions. It has been in the past very largely used as a centre for receiving stolen horses. These it was customary to take into Namaqualand and there exchange them for cattle, which, in their turn, were brought back by the same route and sold in Cape Colony. It was from this town, too, as a centre of operations, that the celebrated showman, Farrini, obtained his Bushman for the Westminster Aquarium in the seventies.

At the time of my visit war was being waged between the Germans and the Damaras, and the residents at Lohututu, being in close touch with what was going on, were gloating over the vast numbers of Germans, both men and women, who had been slain by their friends, the Damaras. This information I received *cum grano salis*. It is a coincidence that, on my return through Lohututu a year afterwards, I heard for the first time of troubles being caused in Cape Colony by the natives on the border of the Kalahari, and on this occasion my friends there were gloating over the number of British killed, though, fortunately, they in no wise molested my party.

After about ten days' stay, I pushed directly north, having immediately in front of me three "thirsts" of respectively 33, 97, and 55 miles. At the only two watering-places, Ohe and Okwa, the water was of very indifferent quality. At Ohe there had been cut out of the limestone a hole about 3 feet deep, from which water sufficient to satisfy thousands of cattle every day is obtained. It is impossible, with the present limited means at the disposal of the natives, to make any impression on the water level, and this points to an almost inexhaustible supply underlying the Kalahari. The theory which I have formed in this connection I now advance for what it is worth. The Okovango River, which rises about 1,000 miles north of Lake Ngami, has no outlet to the sea—it runs inland, and is lost in the swamp near Lake Ngami, and in the salt lake of Makarikari. The water which is brought down by this perennial stream must disappear in great part by soakage as well as by evaporation, and as the surface of the Kalahari, with its underlying strata of limestone, is horizontal, it is reasonable to suppose that a very large portion of the water of the Okovango River has forced its way between the layers of the desert limestone. In every portion of the Kalahari, where the natives have attempted to dig wells, a plentiful supply of water has been found, though in several cases it has been of a brackish character. In view of the tremendous supply of water at a shallow depth, I believe that this so-called desert will hereafter be one of the finest cattle-ranching countries in the world.

Between Ohe and Okwa there was a "thirst" of 97 miles, and, despite the fact it took me altogether seven days to get through, my cattle were not at all seriously distressed, though I had to be very careful to prevent their over-drinking at the end of the stage.

About the beginning of June I reached Ghansi, and found there was a large tract of country free from sand. The vegetation was of an entirely different character, and some very fine trees were noticeable in the neighbourhood. For the human travellers, at any rate, it was quite a pleasure to hear the rattle of the wheels on the hard road after having travelled for three months through sand in which not a stone had been met.

From Ghansi I made an expedition westward into German territory in order to establish the true position of two well-known waterholes, called respectively Olifant's Kloof and Reitfontein. The former I found to be in British, the latter in German, territory. There were at that time no Germans in occupation, but since then it has been an important station of the German police.

Whilst on this mission I was approached by some of the Damara chiefs, who asked me to supply them with ammunition to prosecute their war with the Germans, but naturally I refused to do this, as we were not then at war with our present powerful adversary.

After a brief stay at Ghansi I pushed on for Lake Ngami, having a 60-mile ''thirst'' to negotiate before reaching that place. During this trek I seriously risked the lives of my cattle by one night delaying in order to observe an occultation of a second-magnitude star with the moon, with a view to checking my chronometers, but my halt was valueless and precious time was wasted. The star did not occult with the moon as set forth in the nautical almanac it would do in the latitude in which I was. I naturally was very much annoyed that the time had not been much more profitably spent in pressing onward.

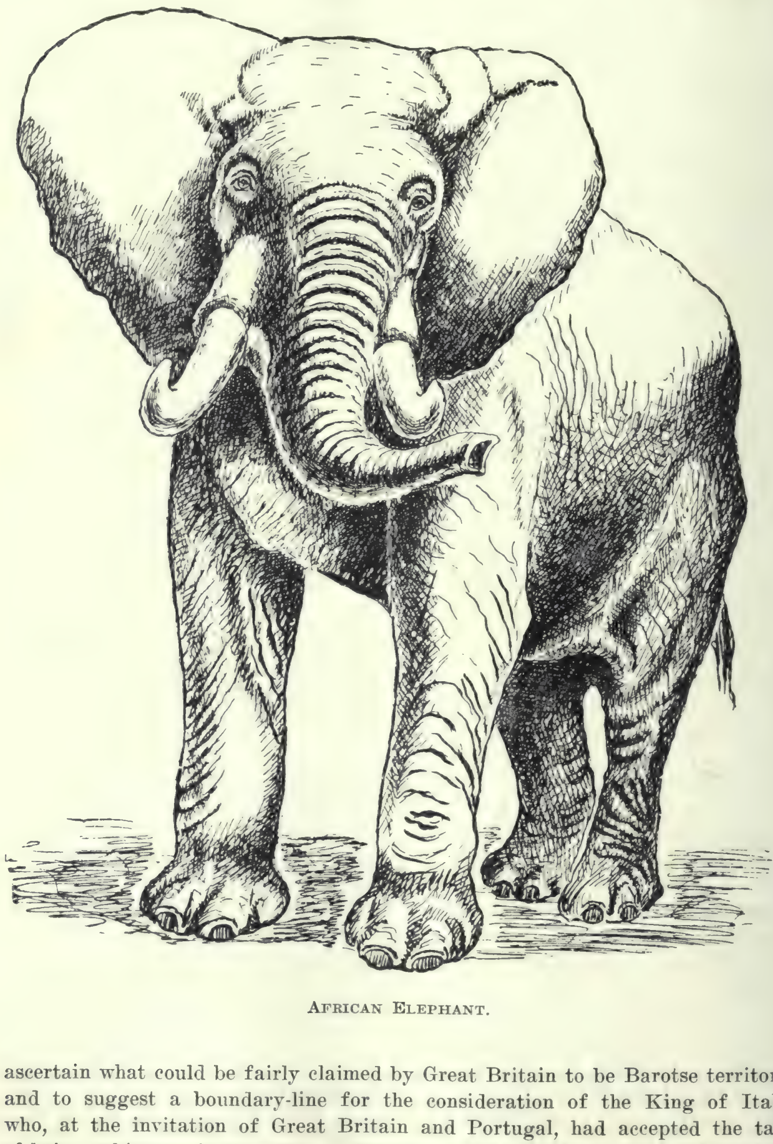
Lake Ngami was discovered by Oswald about 1840, and was first visited by Livingstone in 1849. It was for long assumed to be an inland lake, with defined borders, but, as a matter of fact, it is only a portion of the Okovango swamps, which extend southward from the neighbourhood of Andara's. These swamps are in places as much as 40 miles wide. In some seasons, when water is plentiful, the southern corner, called Lake Ngami, fills up and presents the appearance of a lake, whilst in other seasons, owing to absence of water, it becomes a simple reed-bed, infested with wild animals. Such it was when I passed it, and on the edge of the reeds there was no water of any kind to be obtained.

Immediately to the north of Lake Ngami is the town of Nakalechwe, with about 15,000 inhabitants. This was the headquarters of a chief called Sekome, of the tribe of the Batawana, an offshoot of the Bamangwato, who live on the Transvaal border.

It may be of interest to you to hear a brief outline of certain troubles which have since that time arisen in connection with this chief. According to native law in that part of Africa, when the father of a family dies his wives and family are taken over by the eldest son, and any children who may be born thereafter by these wives are assumed to be the children of the first husband. Sekome's predecessor in the chieftainship was Lechulatebe, a son of a former Sekome. On Lechulatebe's death he left a son, a child of about three years of age, named Matibe, who was the rightful successor to the throne. The Sekome whom I met was the offspring of a slave wife of the first Sekome, born, however, long after his death. He put forward the claim that, as the son of the old Sekome, he was the rightful regent, and he eventually succeeded in getting the young son of Lechulatebe sent to a distant part of the country. A few years after the visit I paid to the Batawana, many of the tribe, saying that he was not the rightful chief, rose against Sekome, and insisted that the young prince should be sent for. A considerable amount of trouble ensued,

and Sekome started out to lay his case before the High Commissioner at Capetown. On his way he was arrested by my successor in Bechuanaland, and to this day he is a State prisoner.

At Nakalechwe I received from the Foreign Office the despatches which had been sent after me, as I had requested. I found that my task was to



AFRICAN ELEPHANT.

ascertain what could be fairly claimed by Great Britain to be Barotse territory, and to suggest a boundary-line for the consideration of the King of Italy, who, at the invitation of Great Britain and Portugal, had accepted the task of being arbitrator in the case. I therefore had to obtain as much information

as possible regarding the character of the control exercised by Lewanika, king of the Barotse, over the tribes lying between Argola and the Zambesi, and to prepare a map of an unknown country whereon I could show the boundary of what, in my opinion, was the Barotse kingdom.

I immediately sent two messengers forward to Lewanika, a distance of about 500 miles, telling him that I hoped to reach a certain place on the Kwanda River on a certain date, and asking him to send headmen down to meet me there to enable me to carry out investigations in that neighbourhood regarding the purpose of my visit. As it turned out eventually, these messengers only reached Lewanika after my arrival at the appointed spot, and I had therefore to wait there for three weeks the arrival of the Barotse headmen.

At Nakalechwe, too, I received reports of the presence of rinderpest amongst the game on the banks of the Okovango. On the route which I was about to take, dead hippopotami and buffaloes had been seen, and I therefore decided to leave my two wagons behind and to limit my outfit to what could be carried in a Scotch cart, trusting to luck that the animals would not get affected with rinderpest before landing me at Andara's, 200 miles to the north. I left Cole in charge of the wagons, and directed him to return to the Kalahari if he found that the wave of rinderpest was gradually coming towards him, and also that if the cattle which I was taking returned to him he should exercise the greatest care to see that they were not affected with rinderpest.

I had a very interesting journey along the banks of the large Okovango swamp, and collected a good deal of geographical knowledge with reference to its boundaries and the streams running into it. One very peculiar feature here deserves notice—viz., that in certain seasons an eastern branch of the river made its way into the watercourse leading from Lake Ngami to the Makarikari, and, if at that time there happened to be no water in the Lake Ngami, the stream flowed westward into the lake; if, however, the lake was full, the stream flowed eastward, and was eventually lost in the sand of the desert.

I ascertained that a subject tribe of the Batawana, the Bakoba, were occupying the islands of this huge swamp. Fear of predatory slave raids by coastal parties or incursions by more warlike tribes has for generations caused the weaker races in South-Central Africa to place their dwellings either in lofty mountain ranges or in the midst of gigantic swamps, removing from the banks all means of communication. Such, no doubt, was the cause of the Bakoba living where I found them. It is on record that on one occasion a raid made by the Matabele upon the Batawana and Bakoba resulted in the drowning of many thousands of the Matabele, and in the total failure of the expedition, when endeavouring to cross the swamp. A local name amongst the Batawana for the low-class swamp natives is "Ballala Metse," meaning, in Sechuana, "the people of the water." Should there be any difficulty in finding convenient sites on firm ground for building their huts, these natives collect large quantities of the coarser kinds of reeds, pile them together until the mass is capable of bearing the weight of a hut; the mass is then anchored by means of stones, the surface of the platform is smeared with clay, and the hut is then built upon it. Should a stranger venture out into the swamps in a canoe and happen upon any of these native huts, the men, women, and children dive into the water and hide themselves in the reeds. They seem to have no fear of crocodiles, which are plentiful, and live on friendly terms with

them. As we travelled along the banks, the swamp resounded with the chattering of large numbers of natives, but not a soul was visible. I have to confess that several of those whom I did see appeared not to have been frightened for many years.

When I got to within 20 miles of Andara's I began to pass through undulating country, and for the first time saw the Okovango River running in a narrow channel. Where the first narrow is met with the river is about 150 yards across and from 6 to 8 feet deep. At this point the stream runs

On the Zambesi—The Governor's Canoe.

Baboons Catching Locusts.

fairly rapidly, and a calculation could therefore be easily made of the quantity of water which comes down each year and eventually is evaporated or finds its way by soakage into the limestone.

Just before reaching the village I met the first belt of tsetse fly. A good deal more is now known of this pest than at that time. It was then assumed that the fly could breed only in buffalo droppings, and that, if the buffaloes were exterminated, the fly would also vanish! The limits of the country infested by the fly were well known to the natives, and seemed to be so sharply defined that it was perfectly safe to travel stock within a comparatively few yards of the edge of the fly-belt. The belt to which I have referred forced me to leave the river for over a day and to make a wide detour before

reaching Andara's. As it eventually turned out, my cattle escaped both rinderpest and the tsetse fly. My two horses and my dog, however, were not so fortunate. The former, on being chased by a leopard, stampeded into the fly-belt, and the latter thought it necessary to pursue the pursuer; hence all suffered. No immediate effect is noticeable in animals when first bitten by the tsetse; they simply pine gradually away, and eventually die of debility, the process being accelerated if the suffering beasts should happen to get chilled by showers of rain.

The place to which I have referred as "Andara's," and which is so called in the German-Portuguest agreement of 1884 as well as in most maps, is a village where Andara, the old chief of the Bampu Kush tribe—a great "rainmaker" of his time—used to live, and where Lebebe, his successor, was living when I visited the place. The village is situated on a small, narrow island in the Okovango River, a little distance above the Popa Falls. After the death of Andara, the tribe of the Bampu Kush was divided into two portions under the respective leaderships of Lebebe and Monkoya, the former being a son and the legitimate heir, and the latter a nephew, of Andara. On the death of the old chief, Monkoya stole from the dead chief's hut certain tribal heirlooms, which were supposed to confer upon the holder the power of making rain. In consequence of this mystic endowment, a portion of the tribe elected him as their chief, and he and his followers proceeded to establish themselves on the Kwando River, where (as will be hereafter described) I visited him.

Having now arrived within the area which might possibly be included in the Barotse kingdom, I at once proceeded to ascertain what influence, if any, was being exercised by the Barotse king, Lewanika, over Lebebe and his portion of the Bampu Kush tribe, but the task was almost hopeless, as no two of my informants spoke alike. I also carried out most careful astronomical observations to ascertain the exact latitude of Lebebe's town. My observations were afterwards checked by the Geographical Society in London, and proved conclusively that the town was about 1½ miles south of the 18th parallel. Great Britain, therefore, in extending her protectorate up to the 18th parallel, had overlapped into the German and Portuguese territory.

The Bampu Kush are a small tribe, scattered throughout 1,200 square miles of country, and are more akin to the Mambunda tribes of the west coast than to the Bechuanas of the south. Individually they are untrustworthy, lazy, addicted to thieving, and both males and females are scantily clad. The women go to a good deal of trouble to interweave with their natural hair bark fibres, which, when smeared with a mixture of grease, red clay, and powdered roots of sweet-smelling grasses, give the appearance of long tresses, hanging in rich profusion oftentimes below their waists.

Owing to the existence of tsetse fly and rinderpest along my further route, I was forced to send back to Nakalechwe my Scotch cart and oxen and to depend upon carriers for transport purposes. In my endeavour to get carriers to enable me to proceed on my journey, I had many interviews with Lebebe. I found him to be quite different from his followers, he being a hard-working individual, exceedingly skilful in working up crude iron into various articles. Amongst those which I saw him making was a spring for a Martini-Henri rifle—a most difficult task for any unskilled mechanic.

I had to subdivide my food and my trading stock into small packages suitable for transport by native carriers. The difficulty in this connection was to estimate the load which could be borne by men unaccustomed to such work, for it has to be remembered that I was in a country where travellers such as myself had been previously unknown. After a stay of about ten days I eventually succeeded in getting twenty-five carriers, but they would not lift a package until I had handed over their wages into Lebebe's keeping. My engagement with the chief was that the carriers should accompany me to Monkoya's town, a distance which I imagined to be about 150 miles, and on the distinct stipulation that the porters would carry out the contract I paid to the chief the specified amount of calico and beads for each person. I instructed the chief that he was not to pay the boys unless he got from each returning carrier a piece of paper inscribed with my name, a specimen of which I gave him, and without which he would know that they had not completed their undertaking. As previously mentioned, the only currency in that region is bartering goods, the four most desirable commodities being limbo (a coarse calico), beads, brass wire, and salt; the latter is the most valuable, but naturally can be carried only in very limited quantities. One great difficulty experienced by travellers in this country is that each particular tribe, or portion of a tribe, has its own special kind of bead, and it is useless to try to induce them to accept any other than the beads of their choice. The two varieties most in favour are a turqoise-blue bead about the size of a pea, and the red "white-eye," a small bead about the size of a grain of millet, touched with white at either end. The British calico, such as that with which I had provided myself, was in great favour with the natives, and they readily appreciated its superior quality when compared with that which they were accustomed to obtain from the Portuguese traders. The unit for measuring limbo is the length necessary for making a native loin-cloth, approximately two yards.

Our first day's march was about 19 miles, and we camped near a beautiful spring of clear water. All along the route numerous herds of game were to be seen. No sooner did I endeavour to get the carriers under way on the following morning than I was confronted with the statement that there lay before me a journey of two days' and two nights' duration through waterless country, and that it was necessary to prepare for this by getting fresh meat to carry them through. A special request was put forward that I should at once shoot the necessary game for their requirements. Not knowing the wiles of my friends, and assuming that their statements were correct, I was only too willing to oblige them. As the sequel proved, these lazy Bampu Kush merely desired time to hunt up their Bushmen to carry their loads for them, and they desired quantities of meat, so that when they had deserted me, as they intended, they could lift it on their way back and carry it back to their homes. I started off gaily with Worrall in a forward direction to try to shoot the looked-for game, and after going about 3 miles I was surprised to discover close to the path a beautiful pan of fresh water. I shot some animals, and then returned to camp. I informed my carriers that they had been deceiving me in regard to the absence of water on the route. They in their turn swore that they did not know that there was any water in that pan, and that assuredly it was the very last. That evening, instead of my having only twenty-five carriers, there were in camp an additional seventy or eighty Bushmen. I did not interfere with the arrangements made by the Bampu Kush with their servants, though naturally I was intensely disgusted with the former.

The particular Bushmen then in camp were different from any whom I had previously met. They were taller, coarser, and of a more robust type, and styled themselves the Mabogakwe.

As I proceeded on my journey I discovered that the native who was carrying my own bag was regarded by his fellow-natives in the light of a god. I have no idea what their system of religion was, but his worshippers did not

LION ROARING.

From an ancient coin, dating from 400 B.C., which was secured by the Governor in Cyprus.

appear to accord him any great respect or homage, nor did they seek to save him from doing his full share of arduous work. In spite of this, howover, they insisted that he was a god, and there was provided a living instance of the unique phenomenon of dirt and divinity being regarded as not at all incongruous!

During the eight or ten days that Lebebe's natives remained with me, on three occasions the same statements regarding the difficulty of obtaining water were alleged, and at last I decided to give such canards no further

credence. At each halting-place my carriers, now numbering over 100, insisted on my shooting meat for them, and as I could not see them starve, I complied with their request. The surplus meat they cut into strips, tied in bundles, and suspended in trees. As a reward for my kindness, I woke up one morning to find that every single soul had disappeared during the night. Worrall, Daniel, and myself alone remained, and as far as we could tell there were no natives anywhere in our proximity. After some discussion as to what was to be done, Worrall was left in charge of the baggage, which, fortunately, had always been deposited at night close to where we ourselves slept, and Daniel and I set out in different directions to hunt for the spoors of local Bushmen. After some time Daniel succeeded in tracking one down. He was brought back to camp, shown the calico and beads we possessed, and by this means induced to go off in search of others. After a halt of twenty-four hours we succeeded in obtaining twenty men to carry out baggage to Luiana River, which proved to be only a short distance away. On arriving there I found a small Bampu Kush village, under the rule of an elderly chieftainess. I explained as fully as possible what had happened, and she agreed to provide carriers to take me to Monkoya's, stating, however, that at the time all the men of the village were away getting meat. I afterwards ascertained that the meat to which she referred was obtained from the carcasses of buffaloes which had died of rinderpest. We remained there three days, and then crossed the Luiana. At this point the stream was about forty yards across, and, like all rivers in the watershed of the Upper Zambesi, at certain seasons of the year it overflows its banks and attains a width of from one to one and a-half mile.

In my train of carriers were only three men belonging to the village of the chieftainess, the others having been obtained from neighbouring hamlets. During the first afternoon we traversed about 15 miles, and then halted at the side of a small mudhole, in which were only a few pints of dirty water. The packs were, as usual, deposited in a central spot close to where we ourselves were about to sleep. Immediately this was done I noticed that some of the carriers were taking their assegais and making off in the direction from which we had come. I at once placed myself in their path, and demanded the reason for this procedure. Through the interpreter they informed me that they were going home because they hadn't been paid. As I had already had experience of paying carriers before the completion of the journey, I now refused to accede to their request, and a very heated discussion took place, which lasted until after sundown. Thereafter I could hear the boys complaining animatedly around their fires, and eventually a deputation waited upon me and informed me that they were going away. I asked them to take the goods back for me, but this they refused to do, declaring that, for all they cared, I could remain where I was and perish from thirst. In spite of this exhibition of charity I still refused to pay, and they returned to their fires. As their irritation seemed intense, we took it in turns to mount guard throughout the night. Nothing further took place, however, and next morning I was surprised to behold them taking up their loads as if nothing had happened and proceeding quietly on their way. I afterwards discovered that it was the influence of the three men given to me by the chieftainess which had turned the scale in our favour, as they had simlpy refused to think of going back to her with her commands unfulfilled. On that day's march, which eventually proved to be one of 25 miles, we again passed through herds of game, but I never fired a

shot, feeling sure that if I were to bag anything there would be a repetition of what had happened with the first party. Late in the afternoon, after reaching our landing place, I started out to shoot meat for the boys, but unfortunately, though I wounded two animals, I procured nothing. This, of course, led to further expostulations, and I was now accused of starving them.

Next day we reached Monkoya's, on the Kwando River. This name is applied only to the higher reaches, for the same stream near its confluence with the Zambesa is called the Chobe. At Monkoya's the Kwando ran in three or four channels through a large alluvial plain, which in wet weather was converted into one vast swamp, hundreds of miles long. From our point of vantage it was only just possible to see the trees on the opposite bank. Monkoya's village contained about 300 souls, and there was no appearance of their having any gardens or cultivated lands—in fact, it was difficult to ascertain how they managed to exist.

After having paid off the carriers who had come with me from the Luiana, and having sent by the three boys my special thanks to my benefactress, I at once opened negotiations with Monkoya with the object of getting a further relay of carriers to convey my belongings up the river to Samatette's, the place where I had arranged to meet Lewanika's messengers. A delay of several days took place, during which Monkoya's men were procuring meat from animals which had recently died from rinderpest; these included buffalo, kudu, eland, and certain of the small antelopes. Strange to say, certain of the antelope tribe did not suffer at all—blue widebeeste, roan and sable antelope, hartebeeste, and giraffe being apparently immune. Monkoya told me that before the outbreak of rinderpest there had been herds of buffalo in his neighbourhood, and from his description I estimated that herds numbering from three to four thousand head had been reduced to one or two animals. During my stay at this place I was considerably troubled by the quantity and size of the mosquitoes, which were so vicious and so numerous that I found it absolutely impossible to take any astronomical observations whatever. I have never heard that any other traveller was so troubled.

My journey up to Samatette's occupied only four days. The porters were evidently in a hurry, for they walked me as fast as possible from daylight to dark. During my journey, I noticed on the path a large number of small footprints pointing in a forward direction. These I eventually ascertained belonged to a party of children who had been purchased by certain Portuguese traders along the Kwando River, and who were being taken to be sold in the slave markets of Bihe and Kangombe, in Portuguese Angola. I should mention here that, thanks to the concerted action of many European nations, the old system of slave trading in Central Africa has entirely died out. It, however, had been replaced, at the time of which I speak, by the system to which I have just alluded—viz., the purchasing of children from native chiefs by Portuguese half-caste traders, who are known by the name of Monbari. These persons visited the different parts of Central Africa, and obtained children in exchange for calico and beads. Children between the ages of eight and 12 years are alone taken, as they are then capable of walking by easy stages to the slave markets, but are incapable of after-

wards remembering the route taken. There is thus not the inducement in after years to desert from the slave masters, as they have no idea how to get to their old homes. We have heard a good deal within recent years of the slaves used on the cocoa plantations of the island of San Thome; the children to whom I have just referred form, to the best of my belief, the majority of the persons so employed.

In conversation with one of the native chiefs on the river, he informed me that the party in front of me consisted of about 50 children in the charge of three Monbaris, who had told him that they were running away from the

WHITE-TAILED GNU.

" Englishman " because they had been buying these children. They also advised the chief not to come near me as he had more than one wife, for they told him there were two things which specially incurred an Englishman's wrath—viz., the sale of children and the keeping of a harem.

On arrival at what I was told by my carriers to be Samatette's station, I found that it was only the landing place, the town itself being situated on an island some distance away in the reeds. I saw many of the natives in

their canoes in different patches of open water, but none would come near me, and I discovered later that the stories told by the Monbaris were the cause of this boycott.

As I had practically no food, and there was a scarcity of same, I sent my carriers away at once, and sat down to await the arrival of Lewanika's messengers. My position was anything but a pleasant one. Boycotted, I could not procure local grain or vegetables, there was nothing to be shot, and I had no idea when relief would come. For three weeks I was thus forced to remain in that place, living principally on wild berries, something akin to a miniature mango. Worrall, Daniel, and myself used each morning to collect any fruit which had been knocked down by the parrots, and this fruit we placed in the sand to ripen, daily turning the heap over and picking out the fruit which was fit to eat. Those three weeks I look upon as the period of greatest trial I have ever experienced. At last, to our great relief, we one morning saw our Barotse friends arriving from the other side of the river. In the canoes were two headmen and about 30 warriors, from whom I received a cordial greeting and messages from Lewanika, and, what was then more important, some meal and a plentiful supply of good kaffir beer. Immediately afterwards the local natives came to visit me and pay their respects to the Barotse. At their head was Capitonga, a son of old Samatette. This man arrived in a rather large canoe, and was dressed in a tall hat, a naval captain's coat with gold epaulets, and a loin cloth. He was attended by a savage, carrying a drawn cutlass, in the bow of the boat, and another savage, armed with a concertina, in the stern. He possessed a voice with the gentle intonation of a bull's roar, and when talking to the Barotse, though but a yard distant from them, might for all practical purposes have been addressing a deaf man a hundred yards away. He informed his auditors that it was the Portuguese who had hindered his coming to me, for they had led him to suppose that I would kill him for selling the children of his people, and he pathetically inquired in his gentle voice how was he to get limbo if he didn't sell the children?

Next morning, threading our way through far-reaching swamps studded with small islands, we crossed the Kwando, the passage taking us from 10 o'clock in the morning until half-past 3 in the afternoon. I was warned that we should have to walk throughout the whole night, in order to reach the first water. Naturally, none of my own party felt very strong after the regime of the preceding three weeks, but we started off cheerfully enough about 4 p.m. Near midnight I noticed that Worrall was not with me, but necessity compelled me to walk on, and I reached the water about 10 a.m. the next day, absolutely worn out. After waiting some time I still could obtain no glimpse of Worrall. I then made careful inquiries about him, and ascertained that about 11 o'clock the previous night he had lain down by the roadside in a state of exhaustion. Boys with water had already been sent back to his aid, and with their assistance he eventually reached camp about 11 o'clock that night. The natives could only induce him to walk by tantalising and enticing him with water held a short distance in front of him, and by occasionally giving him very little to drink. In this manner they succeeded in inducing him to continue the journey.

A further 60 miles in easy stages brought us to the edge of the Barotse

valley. The country so named extends along the Zambesi from its junction with the Kabompo to a point near the first rapids above Katima Molilo, a distance of about 140 miles, with a breadth varying from 30 to 40 miles. In dry weather the Zambesi has one main channel, with here and there short loops through the alluvial plains. In wet weather the whole region becomes inundated, and appears one vast sheet of water, dotted here and there with native villages perched on the top of small islands. The population throughout the valley is comparatively dense, comprising about two hundred thousand persons. A large number of tributaries, such as the Luanginga, the Lungebungo, the Luena, the Liambai, and the Kabompo, connect the valley with the distant portions of the watershed of the Zambesi, and it is to this fact that I attribute the great power of the Barotse chief. In a comparatively small area he has concentrated a large population, and at a moment's notice he can send off to a distant point a fleet of canoes containing warriors to any number he may deem sufficient for the purpose in hand. The Barotse are a warlike race, of a physique superior to that of the surrounding tribes, and consequently they have always made themselves felt in the politics of the surrounding country.

About 1833 an off-shoot of the Basutu nation, styled the Makololo, under a chief named Sebituane, migrated northwards, and for a short time established themselves near Lake Ngami, but eventually took up their residence near the junction of the Chobe and Zambesi rivers, at a town called Linyanti. No sooner had Sebituane established himself there than he began to intrigue in Barotse politics, with the result that, on the pretext of going to help a claimant to the kingdom, he eventually obtained paramount control of the country. He also conquered the Batoka, who lived to the east of the Barotse, and became the recognised power in that part of Africa. He died about 1850, Livingstone being with him at his death.

The Barotse subjection continued for about 20 years after the death of Sebituane, but eventually they rose against their conquerors, killed off every single male, and wiped out, with one exception, all traces of the Makololo occupation. Curiously enough, Sesuto, the mother tongue of the Makalolo, is still retained as the official language of the Barotse royal court. King Lewanika came to the throne in 1876, he being a son of the old Barotse chief, Maramba, who had been expelled by the victorious Makalolo. In 1884 a revolution against Lewanika took place, and, flying the country, he hid himself for a couple of years in the swamps of the Kwando. He succeeded, eventually, in getting back the power, and thereupon put to death all his political opponents. A mild-mannered, gentlemanly old person, he now professes Christianity. Since my visit to him he has visited England, where he was styled "King," and was on occasion known to have played the game of "Up, Jenkins," with the fashionable ladies of the city.

The Barotse kingdom proper, as distinct from the Barotse Valley already described, extends from the junction of the Kabompo and Liambai Rivers on the north to the Victoria Falls on the south—a distance of approximately 350 miles. It is ruled over by four separate courts—that of the king himself, at Lialui; that of the king's sister, or the Moquai, at Namita; that of the king's son, Letea, at Kasungulu, in the southern extremity of the kingdom, near the Victoria Falls; and that of the Moquai's daughter,

Acanongiswa, at Sesheke. Each of these rulers is supreme within their respective spheres, but the king retains the power of censuring them or removing any of them from office should he so desire. It will be noticed from what I have said that the king's sister and her daughter are almost on terms of equality with the king and his own son, the reason being that the Barotse, like many other Central African tribes, recognise their chief's eldest sister as second in power in the kingdom, the king's wives having no particular status.

At the king's court there are daily to be seen representatives of many subject tribes, who bring their disputes to be settled by Lewanika. The court is held in a large palisaded enclosure, capable of holding three or four thousand people. In the centre of this enclosure is an oblong hut, with a high-pitched roof supported by strong wooden posts, and with a wall about 3 feet in height, rising from the floor level. The hut accommodates about 100 people, and is built to enable those inside to see everything that is happening in the court-yard. At a definite hour each morning the king takes his seat in the centre of this hut, having seated on the floor on his left hand prominent personages of royal blood. On his right, also on the floor, sit the distinguished natives, headed by the Gamballa, or prime minister, who have been selected by the king as his advisers. These are the men upon whose support he would depend in the event of any trouble arising within his kingdom. The court sits until about 1 o'clock, and during the session the several deputations outside plead their cases, each in its own dialect. It can be imagined that this on occasion leads to a fair modern representation of the Tower of Babel, but in spite of the noise the king's councillors pay due attention to the pleas of each party. When the king finds time to turn from his own particular duties, he refers to the respective councillors for information concerning the complaints which are being preferred. These persons are then expected to enlighten the king upon any of the subjects which have been or are being dealt with by the deputations, and, after due consultations with his councillors, the king gives his judgment, which decision being proclaimed in the court-yard by the royal crier in his loudest voice. A simple device for discovering a guilty person is effected by means of boiling water. The accused is made to dip his hands in boiling water and then throw handfuls of the liquid over his shoulders and down his bare back. If the water causes blisters anywhere the accused is considered guilty; if not, he is allowed to go free, whatever the evidence against him may be.

Since the deposition of Lewanika in 1884 and his subsequent return to power, he has become very superstitious, and, though calling himself a Christian, believes strongly in the existence of evil spirits. For the purpose of restraining these undesirables from approaching too closely to his royal personage, his hut is each night surrounded by a band of drummers, who throughout the nocturnal hours make night hideous with the banging of drums of all kinds and sizes.

During my sojourn in the Barotse Valley I found that the natives suffered a great deal from leprosy, and I was warned on my first visit to the court to be very careful with whom I shook hands, and also to wash my hands as soon as I possibly could afterwards. It has been said by some scientists that leprosy is largely attributable to the eating of decomposed

fish, and I am inclined to think that what I saw in the Barotse Valley provides a strong support to this theory. The Zambesi River has one main channel through the valley, and many small branches traversing the adjoining alluvial plain. In all of these streams there are quantities of fish, and the people of the vicinity largely depend upon them for their larder supplies. After catching a fish they allow it to decompose sufficiently to permit of their squeezing it through their fingers. When in this condition it makes a most savory addition to their porridge, and the combination represents one of their greatest delicacies.

GNU, SHOWING ATTITUDE WHEN STARTING TO RUN.

The king himself undertakes fishing operations on a very large scale. He begins by organising a party of waders at each end of one of these side-channels, and the parties walk towards one another until they almost meet. This manœuvre sometimes occupies a whole week. There is then taken to the scene a huge net, one side of which is drawn through the stream under the fish while the other is doubled over and conveyed to the same bank. Both sides are then seized by an army of men, numbering anything from 500 to 1,000, and the whole net, with fish enclosed, is pulled up high and dry on the bank. At one such cast of the net which I saw, I estimated the weight of fish caught at about 13 tons, the contents of the net being made up of crocodiles, otters, divers, and 18 different varieties of fish, some of which pulled the

scale at 50 lb. The catch was then left on the bank until it was in a putrid condition, after which the inhabitants of the neighbouring villages came down and took what they required.

Whilst on this subject, I should mention that all kinds of string and rope are made from fibres obtained from the barks of various trees. The only method adopted for separating the fibres from the extraneous matter is by human mastication, and it is a common sight to see long files of natives perambulating about, engaged in the pleasant pastime of chewing bark and proudly expectorating the waste matter.

At this point, too, it may interest some of my audience to have a description of the customary method of salute employed by the natives when they happen to met in the daily round of life. When two friends have approached to within arm's length, they both kneel and clap their hands. After this salutation, each with his right hand takes hold of the other's left hand, and vice versa; the left hand is then drawn forward and placed on the breast, though in the case of a relative it is first kissed. After this operation, both parties again clap hands, rise, and proceed on their way rejoicing. As already stated, a king's wife has no social status, and in the event of her bearing a royal child she is bound, on all occasions on which that child may be in her presence, to remain on her knees before him, and to offer to him the customary salutation of clapping hands.

During the period of annual inundation in the Barotse Valley, to which I have already referred, the cattle and other stock are driven to the neighbouring sandhills, and canoes become the only means of communication between the islands upon which the villages are perched. Prior to the yearly flood, the king has constructed for himself a very large canoe, the building of which craft he personally superintends at Lialui, in a yard specially screened off from the prying eyes of inquisitive passers-by. It is supposed that if the canoe is seen by a woman before it is launched there will result fatal consequences for the fair beholder. As soon as the water rises sufficiently high to float the boat, which is styled the "Nanaquando," the king sets out on a hunting expedition, on which he is accompanied by hundreds of canoes. It was one of my tasks, on returning to England, to obtain for the king a large bronze bell to adorn this mystic annual "Nanaquando."

I found in Lewanika's town M. Jalla, of the Swiss Protestant Mission, who had for some years been the sole missionary working amongst the Barotse. During my stay I was kindly given a spare room in his house, and he acted as interpreter in my conversations with the king. I had some difficulty at first in convincing Lewanika that I was indeed the representative of the British Government. It seems that some two years previously there had been a man named Lockner at this town, who had obtained from the king a mineral concession, which was eventually transferred to the British South Africa Company, and which, Lewanika maintained, would never have been granted if he had not been under the impression that Lockner was a representative of the British Government. After many days' discussion, I succeeded in convincing the king of my bona fides, but only after pointing out that I was simply trying to ascertain the size of his kingdom, and was not asking him either to give anything away or to sign his name to any document. He came to see that I was working in his own interests, and, when once satis-

fied, he did everything he possibly could to furnish me with information of every kind. I found him a most intelligent person, and the only native I have ever known who, without any kind of training, was able to depict, by means of lines, the relative positions of mountains, rivers, and other localities. He amused himself by carving hippopotamus ivory, by doing a certain amount of iron work, and by very neatly weaving ornaments with iron and brass wires. He complained very much to me that English traders did not come to him as often as he desired, and that he was thus forced to deal with Monbaris. Having heard from M. Jalla a good deal about his business transactions, I told him that he had been too hard in his dealings with the English traders who had already visited him in the past, and that he could not expect such persons to come to him unless they were permitted to make a reasonable profit on their venture. I ascertained that as soon as a trader desiring to buy ivory, rubber, or other commodities arrived in his country, the king would ask the trader for the latest Cape newspapers, and from them he would ascertain the price of ivory in the Port Elizabeth market on the coast. He would then offer his ivory or rubber to the trader at a fraction below the coast price, and no cajolery would make him depart therefrom. The trader

LION, IN THE ATTITUDE OF ROARING.

was therefore forced either to take back the goods he had brought or to take the ivory at a price which could not possibly pay him, vowing at the same time never to come again. I pointed out to Lewanika the impossibility of traders coming hundreds of miles, at a great risk of serious losses of transport cattle from thirst and sickness, unless they got a good return for their undertaking, and that he himself was the cause of the scarcity of British traders coming to his country.

After several days of discussion with Lewanika, it was eventually decided that, as it would take me too long to visit each individual chief under his rule, I should confine myself to a personal expedition up the Zambesi to see Shinti, the chief of the Balunda, and Kakenge, chief of the Balovale, both of whom Lewanika claimed as his subjects, and that the king should send messengers west into the Mambunda country, commanding the principal Mambunda chiefs to come to Lialui to meet me on my return. Lewanika

informed me that all the native chiefs who acknowledged him as their supreme head were bound by his orders to wear on their right wrists a plain ivory bangle, about one inch in breadth.

In accordance with the foregoing understanding I started out on my 1,000-mile water journey in a specially prepared canoe, attended by about eight other canoes, each holding six persons. The whole fleet was placed under the command of one of Lewanika's headmen, named Miuni. We were preceded up the river by two smaller canoes, each carrying a man and a boy. The duties devolving upon these scouts were: to give due warning of the proximity of any village; to keep a sharp look-out for ambuscades or hippopotami; to spear fish and to collect anything in the nature of food, for each evening these boats had to furnish victuals for the whole of the boats' crews.

Our rate of progress upstream was about 20 miles per day. Each evening we halted, and a rough grass shelter was made for myself and the headman. During the journey I was able to do a good deal of map-making, which was exceptionally interesting, as this portion of the Zambesi was completely unknown, except for a small section which, years before, had been mapped by Dr. Livingstone. Shortly after passing the junction of the Kabompo and the Liambai, I found that the natives on the left bank of the river acknowledged Shinti as their chief, and after traversing about 50 miles I came to the landing-place for Shinti's village. I found that his residence was about one and a-half day's journey away, so I sent him a polite message asking him if he would be so kind as to come down to see me. He arrived three days later, and I had a long and interesting conversation with him concerning his people and his country. He had numerous complaints to make against the Balovale, who, he said, were always encroaching upon his country. Both he and his people seemed to me to be of a very poor type, certainly not of a warlike character, and as it afterwards turned out, I found that he was quite right in his surmise that the Balovale were trying to filch his country from him.

About latitude 12 degs. south, or about 220 miles from Lialui, I came upon the first obstacle to water-travelling in the shape of the Sapuma Falls. These are really a series of rapids about three miles in length, and ending in a final drop of 40 feet. Here is was necessary to carry our canoes overland, and to launch them again above the rapids. A short distance further on we came to the landing-place of the first of the Balovale chiefs, a man named Mushangwangdungu, whose village was distant about three days' journey. Being by this time rather tired of my canoe, I determined to go to see him. My boatmen carried my blankets and the few belongings that were necessary, and after a walk of about 30 miles through swampy country, I arrived at the village. I found the chief to be a fat, prosperous-looking individual and very pleasant. He was an uncle of Kakenge, the paramount chief of the Barovale, with whom, he said, he did not get on at all. He informed me that he recognised the sovereignty of the Barotse over the Barovale, which sovereignty, he asserted, had existed for a great number of years. During the period of the Makololo ascendency in the Barotse country, the rule of the latter in that region had fallen into abeyance, but since Lewanika's return to power the Barovale were again subject to his nation.

After my return from the village I proceeded towards Kakenge's, passing en route the mouths of two large tributaries of the Zambesi, the Luena and the Kiffumaji, which had hitherto been unknown. When I was within one and a-half day's journey of Kakenge's town, I was advised by Miuni to send a messenger to Kakenge, warning him of my approach, and telling him of my mission. I accordingly sent the messenger forward, and myself followed 24 hours later. As I approached the chief's residence I found flocks of natives making great haste towards the town, and it seemed to me that considerable excitement was being manifested. On my arrival at the landing-place I sent a further messenger to Kakenge, saying that I would like to see him. The messenger very shortly afterwards returned with the message that the chief would not see me, but that if I had anything to say, there was a Portuguese officer present who would duly convey to the king any message I entrusted to him. This was the first notification I had obtained that the Portuguese were present at Kakenge's town, and it was the first inkling I received that I had been outstripped in my journey to this particular locality. I determined to make the best of it, realising that the Portuguese officer had evidently instigated Kakenge not to see me. I therefore despatched a message to the Portuguese officer, who, I ascertained, was living, with about 100 soldiers, within a recently constructed earthen fort, which was situated about a mile from the landing-place where I then was. Miuni, on hearing the message, urged me not to visit the fort, as he thought it was unsafe for me so to do. As a result of the message, I was invited up to the fort, and I at once proceeded thither, the time being about 12 noon. I was accompanied by my interpreter and six Barotse headmen. After the exchange of greetings, the officer and I sat down to discuss the position. In his first question he desired to know my business in Portuguese territory. I replied that it was not Portuguese territory, but neither was it British territory; that the whole question was going to be settled by the King of Italy, as arbitrator, and that I had simply come to ascertain whether Kakenge acknowledged Lewanika as his paramount sovereign. I further acknowledged that the British Secretary of State for Foreign Affairs had informed the Portuguese Government that Great Britain would provisionally recognise the Balovale country as falling within the Portuguese sphere of influence. This seemed to satisfy the officer, and we agreed that it was best to have Kakenge present and put to him a specified list of questions. A messenger was accordingly sent by the Portuguese officer, informing Kakenge that we desired to see him at once. Whilst we were awaiting Kakenge's arrival, I noticed that my Barotse attendants were one by one leaving the meeting, until at last Miuni alone was left. He then informed me that he had reliable information that the Portuguese intended to arrest myself and party and to convey us to San Paul de Loando, and he entreated me to get away from the meeting and go at once to the boats, which he had in readiness for instant departure. I replied that the Portuguese officer and myself had arrived at a perfect understanding regarding our mission, and that I did not fear any attempt at arrest. I moreover told him that I had accepted an invitation to stay the night in the fort as the guest of the officer and his wife, and that I could not possibly, according to European etiquette, refuse the proferred hospitality. Miuni was much perturbed, saying that he could not leave me, that he was certain treachery was intended, and he again begged of me to go.

After some little delay a reply was received from Kakenge that he would not come to see us, and that if we attempted to go in search of him he would run away. We therefore abandoned the attempt to interview him. The remainder of the day we spent in interrogating various petty chiefs of the Barovale, and also representatives of the chieftainess Nyakkatoro, a lady whom I have on a previous occasion mentioned as having 70 husbands.

As I surmised, no attempt at arresting me was made by the Portuguese, though I believe that prior to my interview and explanation with the officer he really had made arrangements to place me in custody, and send me back to the Portuguese settlement of San Paul de Loando. I remained a few days at Kakenge's making inquiries into the history of the tribe, and its connection with the great Lovale kingdom of Mutuamvu. Strange to say, I learned additional details about this tribe from the celebrated Tippoo Tib, whom I met at Zanzibar a few months later. My own inquiries led me to believe that the chief was a profligate young man subject to paroxysms of passion, and quite unreliable.

A Facimile of the Thomson Foundation Gold Medal,

Awarded by the Royal Geographical Society of Australasia, Queensland, annually for the best original contribution to geographical literature or for signal service in geographical science.

Our return from Kakenge's to Lialui was uneventful, and, as we were going with the stream, the time occupied was much less than on our upward journey. An amusing incident occurred at the mouth of the Kabompo, where I waited 24 hours to ascertain whether an hippopotamus I had shot would rise to the surface or not. In the middle of the night a terrible thunderstorm took place, and at the height of the storm I heard one of my party talking at the top of his voice. When morning came I inquired as to who had been talking, and the reason for his doing so. I learned that it had been Miuni conversing with the Supreme being, and informing Him that we had been to Kakenge's, that we had killed no one, that we were peaceable persons, and were going quietly home. Presumably Miuni thought that the information proved satisfactory, as the storm actually did cease a short time after his interview.

At Lialui I found several Mambunda petty chiefs, who had come to see me in accordance with Lewanika's orders. I remained there a fortnight, and then, having been provided with carriers by the king to take me through to

Natalechwe, commenced my return journey, visiting on my way the Moquai at Namita. This fat old lady begged me to send her a fox-terrier dog, a picture of one having been seen by her in an illustrated paper. I regret to say that I have never complied with her request.

The route followed lay to the south of that traversed on the forward journey. The trip proved a very trying one, as there was a scarcity of food everywhere. Many days we lived solely upon frogs, which were plentiful, as the annual rainy season had set in, and the country was covered with water. Unfortunately also, Worrall, Daniel, and myself had contracted malarial fever, and each morning we were almost unable to move. We knew, however, that circumstances necessitated our walking, and fortunately each day towards evening the fever was somewhat abated by the process, and we were then able to eat a little food. Our carriers also suffered in a similar respect.

On arrival at Lebebe's I found that he had paid the runaway carriers, and had broached a bag of meal which I had left in his charge. Needless to say, I was intensely angry, but I really was so ill that my sole object was to get to my wagons and write a report of all that I had learned, so that some record should be left in the event of anything happening to myself. We eventually arrived at Nakalechwe, only to find that my wagons had gone south owing to the presence of rinderpest. I also ascertained that Sir Frederick Lugard, then manager of the West Charterland Company, fearing that I had been lost, had gone on an expedition in search of me, and that he had returned without hearing anything of my whereabouts. The chief Sekome loaned me a wagon and oxen so that I might reach my own wagons, then at Ghansi, and I arrived at that place after about four or five days' travelling. Close to my wagons I found game which had died of rinderpest. As soon, therefore, as I had reached the wagons, I started off, and never stopped until I had put 55 miles between the rinderpest and my cattle. I was truly thankful to entrust the management of my further movements to Cole, as both my attendants and myself were utterly exhausted.

After the usual vicissitudes of Kalahari travelling, we reached Mafeking at the beginning of June, 1897, having been away for a period of 17 months. During that period there had been 13 months during which I had received no communication of any shape or form from the outside world, and it may be imagined that I was truly thankful to get back once more to civilisation. As far as I was personally concerned, it took me a long time to recover my strength; but I regret very much to say that neither Worrall nor Daniel did so, and both died within six months of our return.

His Excellency's address throughout was followed by the closest attention and appreciation, and at its conclusion the Governor was accorded an enthusiastic vote of thanks.

The illustrations in this report of African animals are reproduced from sketches drawn by the Governor himself, and conclusively prove that as a pen and ink artist Sir Hamilton Goold-Adams can challenge competition with the best.

SOME REASONS WHY NATIONAL PARKS SHOULD BE ESTABLISHED IN QUEENSLAND, WITH SPECIAL REFERENCE TO LAMINGTON NATIONAL PARK.* (2)

(*With Sketch Maps.*)

By R. W. LAHEY, B.E.

Your Excellency, Ladies, and Gentlemen,—

I intend to-night to give you first a few more or less scientific reasons why more National Parks should be established in Queensland, and then to show you a few slides to try and convey to you some idea of the beauty of the great heritage which has come to you from the hands of the present Minister for Lands, Hon. J. M. Hunter, M.L.A.

1. There are thousands of children in the cities whose only view of the blue sky is in a frame of iron roofs and blackened chimneys, who, instead of the wind in the trees and the bird-music, hear only the discord of traffic and the foul language of the slum streets. The most probable result of such surroundings on the child-mind is to produce a criminally disposed citizen. Surely we can do something better for them! Why not give them a place where they may come and see the beauties of Nature, where God, working through Nature, may so influence their young minds that they may become citizens to be proud of? For the influence of the bush never yet produced a criminal. Who knows but what a Wordsworth is even now looking for his mountains and streams, waiting for them to inspire him to give the world thoughts that will take men through the Valley of the Shadow?

2. Because it would make one of the finest health resorts in Australia.

Three times the summer shade temperature has been measured up there in the middle of the day, and the temperatures were 61 degrees, 63 degrees, and 64 degrees. What would such a place be to the men and women of the West, the people who deserve consideration before everyone else, and to the inhabitants of the large cities? And the scenery is magnificent. Every year hundreds of our people

* Royal Geographical Society of Australasia, Queensland, October 6, 1915.

(2) For a general description of the physical features, geological structure, climate, and accessibility of the National Park, reference may be made to Dr. J. P. Thomson's paper on "Holiday Rambles on the Upper Logan," 1907, *Queensland Geographical Journal*, vol. xxiii., p. 21., and to the Report of the Royal Commission on Public Works on the proposed Beaudesert-Kyogle Railway, 1916, pp. 186-192.—[ED. *Q.G.J.*]

are ordered by the doctors in Queensland to go to the Blue Mountains, in New South Wales, because there is nowhere here to send them. I know several of the leading doctors in Brisbane, and they tell me that it would save many a person's life to be able to go there, but they cannot afford it. What an effect such a place would have on persons suffering from the effects of nervous breakdowns, &c., on men and women worn out by the struggle of life, wanting only a short space to commune with Nature to regain their grip and go back to the struggle with a clear brain and a vigorous body!

3. It is very desirable to reserve a piece of distinctive Queensland scenery.

In a very short space of time the only patches of scrub left in the district will be inaccessible spots unless this proposal is carried out. And with the scrub up there will disappear for ever our lyre-bird (*Menura Alberta*). In this region there is growing also a tree (*Fagus antarcticus*) which once flourished widely but is now almost extinct; in fact, it has only survived in the south of Tasmania and the south of the South Island of New Zealand. It is of very great interest scientifically, and when one stands before one of these patriarchs thousands of years old, one is inspired with a feeling of great awe. In California reserves of thousands of acres have been set aside merely to preserve similar trees from extinction. Moreover, on the butts of some of these ancient trees there grows a kind of fern which cannot be grown artificially and which must disappear with the scrub. Steps should be taken also to preserve specimens of our native birds and animals in their wild state, and this can only be done on a very large scale.

4. All this area has been counted on to help make the Beaudesert Tramway and Logan Village-Canungra Railway pay. If the whole area were opened to selection less than 3,000 acres could be selected. Practically the only traffic from these selections would be cream, and the most we could expect from them would be 8 gallons per acre per annum, giving a total of 24,000 gallons. In the case of the Beaudesert Tramway, the freight on this at 1¼d. per gallon gives an annual traffic of £125. Now, if this area were made a National Park we would expect at least a proportionate passenger traffic to that to Blue Mountains and National Park in New South Wales. Last year 92,143 passengers travelled from Sydney Central Station to National Park, and 79,972 to Katoomba, a total of 172,115. This does not include 13,955 to Wentworth Falls, 9,950 to Stanwell Park, and 29,329 to Hawkesbury; not to mention Lawson, Blackheath, Mount Victoria, Waterfall, &c. Take one-fifth

of 172,000, as the population of Brisbane is less than a-quarter of that of Sydney, and take half of that, giving 17,200 as a reasonable estimate of the passenger traffic. Taking the average fare as 4s. gives an annual passenger revenue of £3,440 as against £135 if opened to selection.

5. It is not suitable for closer settlement. As a result of agitation, three officials have reported on this area. The final report by Mr. Hill, after a theodolite survey of Lamington Plateau so-called, says, "The area of land which might be converted into pasture land is under 2,000 acres; but much of this is very rough, and the amount of really safe land does not exceed 700 or 800 acres." Also, "The land, although on the whole fairly level, is much broken up by gullies, and patches sufficiently even for the plough do not exceed one or two acres in extent." There were also about 1,000 acres of selectable land on Cainbable, but this is all the land available for selection out of about 45,000 acres. Moreover, to open up this land would entail the construction of two very expensive roads, the cost of which added to the selection price would prohibit selection.

6. The whole of this region is extremely mountainous, many of the peaks being almost 4,000 feet high. The effect of scrub on such a mountainous district is—

(*a*) It retards the descent of water to the streams, thus preventing sudden rises in the main channels, and so regulates the flow. At the end of the big drought the streams emerging from this region were still running comparatively strongly. The value of scrub on mountains as a preventive of floods cannot be over-estimated. The effect has been observed for centuries, and is not now doubted by anyone. Millions of pounds yearly are wasted through this cause alone. In Tasmania, in March, 1911, as the result of the headwaters of the George River being cleared of scrub, it rose so suddenly and so high that every bridge of any consequence on it was washed away.

(*b*) It prevents the evaporation of the water from the ground. The ratio of evaporation in scrub to that in the open has been observed very carefully, and ranges from one-third to one-fifth, depending on the thickness of the scrub. It also increases the relative humidity of the air, thus causing increased precipitation.

(*c*) It increases the rainfall. Observations carried out in different countries all go to show that the rainfall over the scrub is greater than that over the adjacent open country by about 10 per cent.* The rain-clouds are continually driving through the trees on top, and moisture is precipitated on the leaves to a great extent; this finds its way into the streams, but is not registered by a rain-gauge.

(*d*) It prevents the erosion of soil on the slopes, the denudation of the surface, and landslips, and so prevents the silting-up of rivers. The experience of some of the selectors at Minden in the Rosewood Scrub bears this out.

(*e*) It reduces the temperature of the air in summer, keeps it warmer in winter, and prevents sudden changes. This has been proved very conclusively on Tambourine Mountain. In fact, the proved opinion of scientific observers goes to show that it affects very considerably the climate of the whole district round about.

(*f*) It reduces the velocity of air-currents.

(*g*) It improves the healthiness of a country. Lord Kelvin said that if the destruction of timber were continued at the same rate as at present the supply would be exhausted in a few centuries, and then human life on the earth would no longer be sustainable on account of the failure of the necessary quantity of oxygen in the air. All these effects can be exemplified by the Southern Appalachian region in the south-east of United States of America. The report of a commission sent to inquire into the effects of deforestation on the mountain slopes there was, *inter alia*, that the damage caused from April, 1901, to April, 1902, was £3,750,000. As a result, an area of nearly 4,000,000 acres was *resumed* at a cost to the nation of over £2,000,000.

7. This area is the natural water supply of Brisbane and Beaudesert. The amount of water running from this area is upwards of 22,000,000 gallons per day. The regulation supply in a large town is 25 gallons per head daily; so that this area would supply

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* This was contradicted by Dr. J. P. Thomson when the paper was read.—[Ed. "*Q.G.J.*]

constantly a population of 900,000. Now, the present main water supply of Brisbane depends on the Brisbane River. There is so much settlement above the pumping station at Mount Crosby that very expensive filtration plants are being installed, and the "British Medical Journal" recently pointed out that even when these are in operation the water will not be pure bacteriologically. The water, however, that issues from the creeks of this area is absolutely pure, and even in times of heavy rain is scarcely turbid, so that expensive filtration is quite unnecessary. The authorities will eventually come here for water, and if this area is reserved now it will save enormous sums in resumption later.

8. It would make a splendid timber reserve. In many places small areas of timber are still left, and in most of the rest of it sylviculture could be carried out under almost ideal conditions. All over the world the increasing need of reafforestation is becoming more and more insistent, but in this respect Australia is far behind the times. We speak as though we had an absolutely illimitable supply of timber, whereas in the annual report of the Director of Forestry I see this statement: "At the present rate of cutting of hoop and bunya pine the quantity of overgirth timber of these species standing on timber reserves and State forests will not last longer than from twenty to twenty-five years." Yet from 1908 to 1912 the soft woods cut each year advanced from 65,000,000 to 108,000,000 super. feet. Evidence given before the Interstate Commission was to the effect that only fifteen years' supply of soft timbers remained in New South Wales. At the same time, enormous quantities of timber are being imported into Australia. In 1913 log timber 23,500,000, dressed timber 86,000,000, and undressed timber 350,000,000 superficial feet were imported into the Commonwealth.

9. It is worth noting that most of the battles in Europe have been for the possession of a forest.

10. The most important reason to my mind is that of sentiment. Only a very stolid, soulless sort of human creature can go unmoved among big trees. In hours of sorrow and trouble men and women turn to the soothing and comforting solitude of the scrub, with its sheltering silence and protection. Our Master at the world's climax went to Gethsemane, which was not a garden as we know it, but a grove of trees.

Vernon Harcourt, a very eminent civil engineer, says that forests increase the beauty of a country and produce a healthy æsthetic influence upon the people.

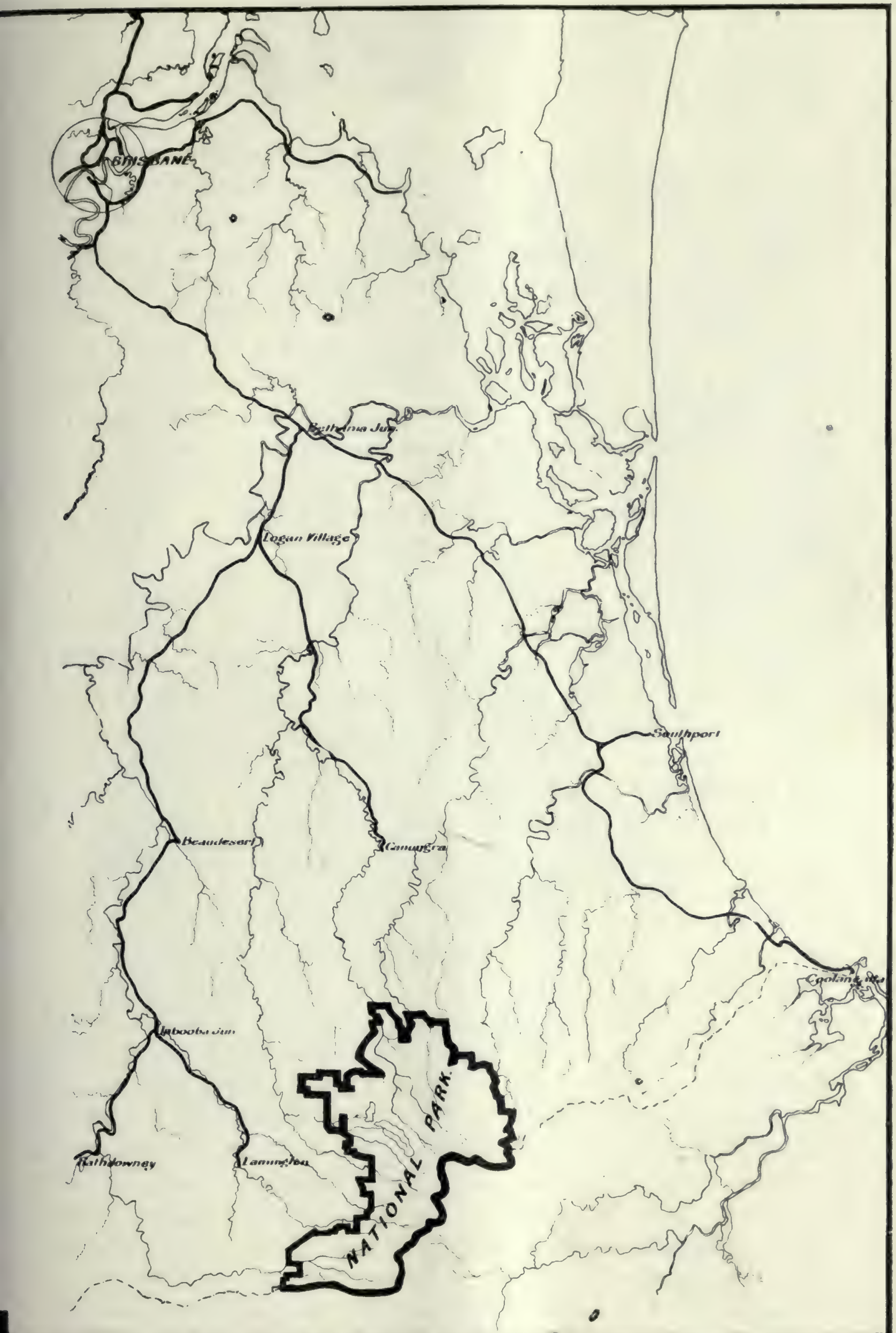
John Ruskin, who bade fair to be the world's greatest writer on art and all things beautiful, and who, driven to despair by the iconoclasm of ignorant men, devoted the rest of his life to the study of political economy, says: "All waste land not necessary for public health, to be made accessible and gradually reclaimed. . . . Not our mountains. . . . our life depends on them more than on the best arable we have."

President Roosevelt, in dedicating the Appalachian Reserve, in his message to Congress, said: "In cases where natural conditions have been restored for a few years, vegetation has again carpeted the ground, birds and deer are coming back, and hundreds of persons come each summer to enjoy the privilege of camping. Some at least of the forest reserves should afford perpetual protection to the native flora and fauna, safe haven of refuge to our rapidly diminishing wild animals of the larger kinds, and free camping grounds for the ever-increasing numbers of men and women who have learned to find rest, health, and recreation in the splendid forests and flower-clad meadows of our mountains. *The forest reserves should be set apart for ever for the use and benefit of our people as a whole and not sacrificed to the short-sighted greed of a few.*"

In conclusion, let me urge upon you the terribly pressing necessity of reserving large areas as National Parks and State Forests all over Queensland, before the hand of the destroyer has set back the work for hundreds of years.

As showing the importance that attaches to this subject, I may say that in Canada a National Park has been proclaimed which is 250 miles long by 25 miles wide. Some of the more important reserves in the United States of America are—

	Acres.
Yellowstone Park	2,119,680
Grand Canyon, Arizona	1,851,520
White Rivers Plateau, Colorado	1,198,000
The Sierras, California	4,096,000
Mount Ramier, Washington	2,027,250
Cascade Range, Oregon	4,577,000
Bitter Root, Idaho	4,147,000
Mount Washington, Washington	3,426,000



MAP 1.—SOUTH-EASTERN QUEENSLAND, SHOWING THE NATIONAL PARK.

The total area of National Parks and Forest Reserves in United States of America in 1902 was 60,162,525 acres. The total in Queensland at the present time is 960,000 acres.

Map 1.—This is a map of the south-eastern portion of Queensland, extending from Brisbane to New South Wales. The area surrounded by a heavy black line is the recently acquired National Park. The circle surrounding Brisbane is 5 miles in diameter, giving you an idea of the accessibility of the reserve as regards distance from Brisbane, the various railways of access by way of Lamington, Canungra, and Nerang being shown. The thick marginal lines represent Yellowstone Park, in U.S.A., to the same scale. Yellowstone Park, as I have shown, is by no means the largest National Park in U.S.A., yet look at this little square in the corner: it represents to scale 1,000 acres, the maximum amount which the Beaudesert Shire Council was willing to allow for a National Park.

Map 2.—This map shows the reserve to a larger scale. The thick line is the boundary; but you will note that there are two areas included within the reserve. Unfortunately, disastrously rather, I took the field five months too late; these areas had been selected, and three successive Ministers refused to resume them. When I first saw the block at Moran's Falls, including the lower end of the upper part of Moran's Creek, it was one of the loveliest sights mortals are given to see. Now, go and look at it! The creek is full of dead trees, the landscape is a discord of blackened stumps and rank second growth. Most reserves start off handicapped by the results of past wrongs; in this reserve we have only one such to combat, the unreserved selections on Cainbable; let us see to it. But I am off my track. To those of you who do not use relief maps, I may say that the lines on this map represent the slope of the ground, the long thin ones representing gentle slopes, and the short thick ones very steep slopes. You will see that on the south the Macpherson Range falls practically sheer into New South Wales, while on the north it slopes down into Queensland, running out into ranges which extend as far as Beenleigh. You will see also that practically all the rivers of South-Eastern Queensland have their headwaters there. Commencing on the east, you have Nerang, then Coomera, then Canungra with its two branches, then Albert with its two branches, and Cainbable and Moran's Creeks, then the Logan with its two branches, generally called Running Creek, and also Widgee

Map 2.—Showing the Physical Features of the National Park.

and Christmas Creeks. You will also note that, as I said previously, the country is all extremely mountainous. Some of you are no doubt looking for the famous Lamington Plateau; well you might. Many others have looked for it on the ground, too, and still it has not materialised, and like all other myths it is not likely to.* Cainbable also (which some people for no apparent reason call Roberts's Plateau, Mount Roberts being between Nerang and Coomera Rivers) is a similar case.

I propose now to take you with me in fancy for a trip which I hope before long you will be able to take in fact. We will first go and stand on Beech Mountain, near Mount Roberts, and look over into Nerang Creek, then go up Coomera River, then up Canungra Creek (west branch), then up Running Creek, along Macpherson Range, and down along Cainbable.

This is looking across Nerang Creek from Beech Mountain; the mass of rock in the middle distance is Egg Rock Mountain, rising almost straight out of the creek. On the right is the end of Mount Roberts.

We will now assume that you have been transported on to Table Top, on the divide between the Coomera and Canungra. You are now looking east across the valley of the Coomera to Mount Roberts; the cliffs on the side of Mount Roberts, although they do not give the impression of great size, are up to 500 feet high, and extend for about 3 miles along the eastern side of the gorge through which the Coomera runs. At intervals smaller creeks running off Mount Roberts and the Darlington Range plunge over these cliffs, becoming plumes of spray swayed from side to side by the breeze and watering the gardens of rock plants clinging to the crevices in the rock. This gorge ends in a magnificent sight: the cliffs suddenly meet, and the Coomera falls through the end in one leap of over 100 feet. Through the ages it has worn itself a cleft about 50 feet deep and 15 feet wide through which it pours. To reach this one can follow the old cedar track which follows along the bottom of the valley, continually crossing and recrossing the creek, and at each crossing exposing views of magnificent beauty. At one such crossing is a huge beech tree, and at Christmas time, with its glory of blue flowers and the pool below dotted with the same, it is a sight worth travelling for. Towards the end the cliffs on Mount

*Lamington Plateau forms the southern portion of the National Park.—[Ed. "Q.G.J."]

Roberts tower above you, and the valley as such ceases to exist as the cliffs come down almost to the creek. It is a weird experience to camp at night in this gorge. The sun shines for so short a time each day in the bottom, and there is so much moisture about that the growth of fungi of all sorts is encouraged. The small luminous variety is very much in evidence, and as it grows not only in the bottom but up the sides of the gorge as well, it is hard to say where the fungi end and the stars begin. Along this gorge is some of the loveliest scenery it has ever been my lot to see—palms, tree-ferns, and waterfalls forming kaleidoscopic combinations. Strangely, the only waterfall in the main creek all the way up to the end of the gorge is one about 10 feet high.

To continue our journey up the Coomera we must now retrace our steps a mile or so till we can climb up the western side of the gorge. Once on top we skirt the edge of the cliff till we get past the end of the gorge, and then descend once more into the creek. This descent is more or less voluntarily, mainly less, as it is very damp and almost perpendicular. Once more as we proceed we get into a mild form of gorge. I will show you a picture of a camp I once had here; it is not a portrait study; it is to show how little valley there is. The camp was formed by filling up a hole with stones, covering them with branches, and over them laying palm-leaves. Immediately behind is a precipice, immediately in front is the creek. This is no stage arrangement, as the only alternative was a hole in a rock shown in the next picture. In the pool at the foot of this fall two of us had a swim three days after New Year's Day, but it was so cold that we could not breathe. It is about 3,000 feet above the sea, and the sun never shines on the water.

The remainder of the course of the creek is a succession of small falls, the last being only a few hundred yards from the head, the actual source being only a few yards from the watershed, which is the border between New South Wales and Queensland. It is a strange sight after days of scrub and creek to emerge suddenly at the top of a precipice nearly 1,000 feet high with the north-eastern corner of New South Wales spread out like a map at your feet, the whole countryside dominated by Mount Warning. And if you want to see something to inspire you, camp for the night; watch the purple in the valley of the Tweed and along under those gigantic walls turn slowly darker as the bare rock on the face of the cliffs turns a deeper orange in the glow of the setting sun. Then watch

the stars that gleam so bright that they seem only at the distance of an outstretched arm. And in the morning you will think you hear the Pied Piper, but it is Nature's orchestra playing the prelude to the daily marvel, the dawn. And at your feet is a sea of billowy clouds breaking on the precipice at your feet, with Mount Warning an isle in the offing.

Now let us have a look at Canungra Creek. We will start on Table Top again, but on the western side this time. From here we look down into the valley of Cunungra Creek and see glimpses of the water rushing among the stones apparently directly below us. Farther up the creek and towering over it is Pyramid Rock with its chopped-off end; beyond that again and for miles along the other side of the creek is Cainbable, and over it we get a glimpse of the mountain known as the Jump-up, between the Alberts. Now we will descend into the valley and follow up the old cedar track as before. These tracks were made by bullock-drivers in search of cedar-trees, in the days when a man paid a merely nominal price to destroy thousands of pounds' worth of cedar by cutting it and then leaving it to rot.

Just before we enter the Reserve we come to an old house in a small clearing. This place is fairly emblematical of what happens to selectors in this out-of-the-way place. It is a monument to the old pioneer spirit, being built entirely of split pine, even the furniture being built in the same way. But it was 30 miles to the railway, so the wild-goose plum-trees are growing through the veranda.

For the first few miles the scenery is very similar to that of the Upper Coomera, but 2 or 3 miles above the old humpy we become aware of a something which seems to threaten, and on looking up we discover Pyramid Rock towering above us. It is a majestic sight when viewed from below, and the view from the top is magnificent. The ground falls sheer from your feet, so there is no foreground, and it gives you the idea that you are viewing the landscape from a place apart.

A little way above Pyramid Rock you meet the first waterfall and also the first palms. These piccabeens do not grow in the lower levels, but from this point up they and tree-ferns abound. This is characteristic of all the streams in this National Park. From this point right up to the head of Canungra Creek it is one long succession of cascades and waterfalls. I will show you photographs of a

score or so, but they can give you no real conception of the beauty of the place. One shows a peculiar formation; at the top and bottom of this fall are circular pools of great depth in solid rock. They are so deep, in fact, that in the middle of the day, with the sun shining through perfectly clear water, there is no sign of bottom in either of them. Close by is an enormous wasps' nest, or, rather, community of wasps' nests, built all over a rock. I cannot tell the learned ladies and gentlemen what colour the undersides of their wings were, as we considered, with Mark Twain, that that rock belonged to those wasps.

There is nothing in Canungra Creek corresponding to the gorge in the Coomera; the creek-bed rises continuously, with the ground sloping up steeply on both sides. One noteworthy feature of the Canungra falls is the great number of logs which one sees at each of them. The inference to be formed from their appearance is that they have fallen higher up on the side of the mountain and slipped down the steep slope into the creek-bed. To give you an idea of the uniform steepness of the slope of the sides of the valley, I might mention a case in point opposite Pyramid Rock. Here a mass of rock fell away from the cliff which runs along the east side of Cainbable and cleared a swath to the creek, a distance of a mile or more, as neatly as though a huge mowing-machine had passed down the slope. Near this same spot is a celebrated cedar-tree. A bullock-driver, an old identity in the district, was once looking for timber and found this tree. It was a tremendous tree, so he said nothing about it, and at the first opportunity came back and began to fell it. He was a good axeman, but after several days' work he had not made much impression on it, so he got on his horse and rode round it, and when he got to the other side he found two men who had been cutting at it for three weeks! I may say that I have never seen the tree, but I am an optimist.

Now let us turn our attention to Running Creek, that is the head of the Logan. Almost as soon as you reach the top selection up the creek the valley bottom narrows down almost to nothing, and almost immediately you encounter waterfalls and cascades only a few yards inside the Reserve. At quite a short distance above this Running Creek divides into two equally important branches. On the maps only the southern branch had been shown, and people were led to the belief that, because no creek was shown between this and Christmas Creek, the country between must consist of a

great plateau; this had much to do with the establishment of the idea of Lamington Plateau, the other main contributing cause being the fact, well known to bushmen, that in thick scrub distances are very much over-estimated. As a matter of fact, what is shown on the maps as Lamington Plateau is in reality the watershed of the north branch of Running Creek and of Waterfall Creek. You may think that Lamington Plateau is a bee in my bonnet, but even well-informed people still persist in the fallacy. At the same time, I would like to refer to the habit which some people have of calling the whole area Lamington Plateau—first, as I have just said, Lamington Plateau does not exist; second, the area called by that name is only a small part of the whole, and is situated at the extreme western end; and third, the National Park extends right out to Nerang Creek.

But to return to the south branch of Running Creek. I have no photos. to show you of this branch, unfortunately, but at some future date I shall show you a more complete set of the area. This branch is very similar to the northern one in many respects; there are towering precipices on each side and one of the grandest waterfalls in Queensland, reported to be 600 feet high, and certainly looking its height. Following up the north branch, we begin to rise immediately, and again we encounter a succession of beautiful falls. Wherever the solid rock appears we have a waterfall, and in between the water runs among tremendous blocks of stone. Occasionally through the trees on the east bank we get a glimpse of the precipitous end of the divide between the two branches, towering up over 2,000 feet above us. Mick Leo, an old identity up there, once said that it took two of them a day and a half to see the top! There are different waterfalls along this branch.

You will notice in most of the pictures a species of plant which you may have noticed in the views on the Coomera. They resemble huge lily plants, but the flower is like that of a rush. The leaves are often 6 or 7 feet long, and they form a setting for most of the waterfalls up there. In the Christmas Creek district they are called Buchanan's lilies, a small enough recognition of a fine old pioneer gentleman who has long advocated the National Park.

At about two miles from the boundary we meet a damp steady breeze which is generally the first indication of a big waterfall, and sure enough on rounding the corner we meet a magnificent sight. The creek falls almost vertically between 200 and 300 feet into a

tremendous amphitheatre. At the foot of the fall is a pool about 120 feet in diameter, and on it are quite large waves caused by the rush of air carried down by the falling water. The drooping veil of falling water is swayed by the fitful breeze, and occasionally swings out clear of the rock at the bottom and falls into the pool, making a deep note. This note is reverberated by a cave which you see in the picture, and gives a sound exactly like thunder. Different views of this waterfall reveal its beauty, none of them, however, giving you a true conception of its height. A better idea of its size will be obtained by comparing the little fall at the top of it with the picture on the screen, which represents the same fall. The next slide shows the view looking back and down into the valley from the top of the fall. The last time I was there two of us camped on a big flat rock near the foot of the fall, and built a fire on another rock beside us. Just after we had turned in for the night there was a terrific explosion, and the fire was scattered all over us and the landscape, and a big piece of the rock was blown out. From here on there is the same succession of waterfalls, but tree-ferns become much more numerous; in fact, the whole of the land above, about 2,500 feet high all over the Reserve, is covered with tree-ferns. The strange things about all the main creeks is that they run in narrow valleys, and receive practically no tributaries until near the head, when they suddenly run out in all directions.

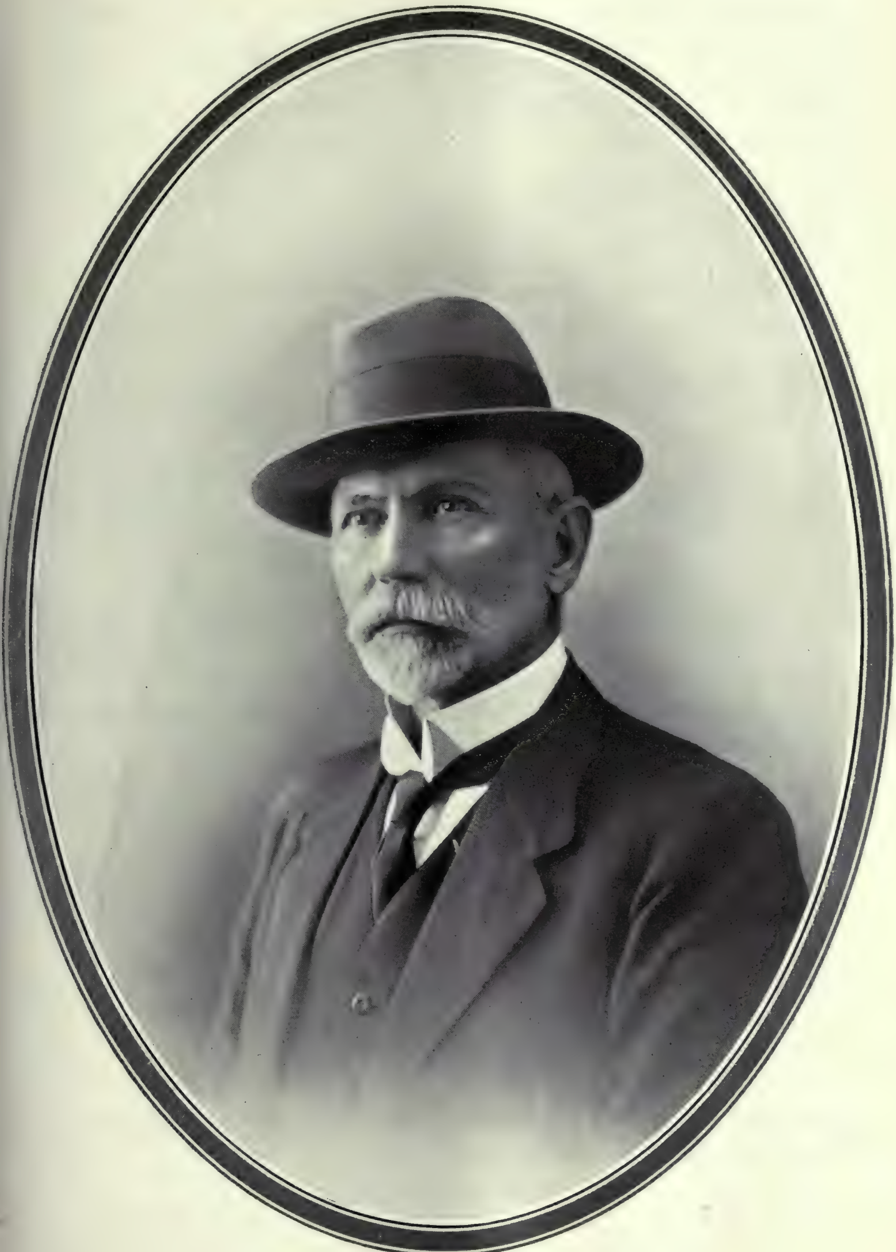
We will now climb out of the creek-bed, where we have had to travel ever since leaving the big fall, and make a cut across until we strike Buchanan's old track. This track was cut during the big drought to open up the country and to give work to the unemployed, and except in a few places is still quite easy to follow. Let us hope it will be repeated on a much larger scale in the near future.

After following this track a little while to the east we come to the New South Wales border, which there is no mistaking, as a few yards further on the cliff falls sheer into New South Wales. From here we get a magnificent view all over the north-east of New South Wales and along the border both ways. Right opposite to you as you come to the edge is Mount Warning, dominating the whole Tweed district. In the mornings Mount Warning, like Mount Lindsay further west, is a veritable cloud factory, due to the warm air striking the cold mass, causing condensation. It is a beautiful sight to see cloud-masses forming and streaming away in a never-ending procession as though issuing from the bowels of the mountain.

From this point we can follow Buchanan's track northward, closely following the old border survey, which, although gone over twice in the last sixty years, has been almost entirely obliterated by the phenomenal growth. The contrast between the two sides is very great. On the New South Wales side there is a sudden drop into fairly flat country, the drop being so sudden that at only two points in the whole length of National Park can a track be got down into New South Wales. On the Queensland side, however, the land slopes easily into a great succession of ranges and valleys running out into Queensland. At many points along this track magnificent panoramas, embracing the whole of the Tweed district and border country, can be obtained. Other slides show something of this, but unfortunately they were fogged, so the fine detail, including the sea (which is quite plainly visible) is not shown.

In the next view, on the right you get some idea of the slope down into New South Wales. Then far away on the left that double-headed mountain is at the head of Tallebudgera Creek, the mountain to the left of it is Springbrook, and to the right of it is the Razorback at Tweed Heads. This high land along the border is extremely interesting. The track in many places is lined right and left with tree-ferns, which predominate among the undergrowth. There are also a great number of those *Fagus Moorei* of which I spoke. This slide shows one of these old patriarchs; this is only one tree, the different stems uniting in one common butt.

After following the border along for several miles, past the heads of Christmas Creek and the Albert River, the track turns off to the north-west along Cainbable. At first nothing is visible but the scrub all round, but after two or three miles we come to the aforementioned clearing at the mouth of Moran's Creek. I will not speculate on your feelings, but we will hurry through it and get down to the cliff over which Moran's Creek falls in such a beautiful setting. Standing here you will see one of the grandest panoramas of South Queensland. It is not so extensive as one further along Cainbable, but it is set in the valley of Moran's Creek and is indescribably beautiful. In addition, Moran's Falls itself is a gem. When you suddenly realise that you cannot enjoy this wealth of beauty without trespassing on private property, and that to return to the road you must cross private property, you will begin to realise the tragedy of the words "too late." Returning to the road and pushing on again, we come out into open country at the top of a



HON. J. M. HUNTER, M.L.A.,
Secretary for Public Lands, by whom the National Park was set apart for public use.

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precipice which runs along the western edge of Cainbable for its whole length. This is, from the point of view of extent, the show panorama of the National Park. It embraces all the country from Richmond Gap to Brisbane and out to the Main Range. From here you get an excellent view of the tremendous rampart of cliffs along the north side of Lamington Plateau, also Buchanan's Fort, described by an oldtime identity, one Mick Leo, as "a shtone wall lak' th' ind av the wurrld."

There are several creeks falling over this cliff at different points, each making a picture. Cainbable Creek and Falls are very similar to Moran's Creek and Falls. From here the track crosses over to the east side, emerging in open country at the top of a cliff, from which a magnificent view down into Canungra Creek and across to Pyramid Rock and away beyond to Tambourine Mountain is obtained. Just beside is a little creek, and if any of you want to know of an ideal camping place for one who wishes absolute peace let me recommend this place to you as the best I know.

From here the track follows the top of Cainbable and at this point leaves the National Park, which is a great pity, as the whole view from Table Top will be spoiled when this scrub is cleared. About two miles along the track turns east, and goes down into Canungra Valley at a slope which would necessitate a crow using a breeching to go down it, arriving on Canungra Creek just beside our old friend, the wooden house.

Now, ladies and gentlemen, that is all I have to show you. If seeing these pictures has given you a fraction of the pleasure which seeing the originals has given me, then I am indeed happy. But I want you to realise one thing: that this great heritage for your children's children for all time you owe to one man, the Honourable J. M. Hunter, M.L.A. This gentleman, when the matter was brought before him, based his decision, like the Greeks of old, on one question—"Is it for the good of the State?" But we must not forget the pioneers who paved the way, who fought and worked for the great ideal. Their work has now borne fruit, and we must always associate the National Park with the names of Robert Collins and your worthy secretary, Dr. J. P. Thomson.

Mr. H. TRYON, speaking from personal knowledge of the Macpherson Range border lands of Southern Queensland, and of much of the area embraced in the National Park—the subject of the lecture—and, indeed, having had the

fortune to accompany Sergeant Lahey, *viâ* Cainbable, to some of the more elevated positions that it comprised, he considered, he said, that Queensland was to be congratulated in what he—the lecturer—had achieved for it, as the outcome of the explorations that he had prosecuted during several years, and efforts in the public interest, prompted by what these had disclosed. The area dealt with was, in fact, one of the very greatest interest and importance, and most worthy of being recognised as a National Park and of being preserved as such.

Mr. Lahey, in his introductory remarks, had advanced many sound reasons in support of this proposition, and it was not necessary for him to further dwell upon them.

He was very much struck, however, with the fact that, after having wooed Nature in these lovely mountain solitudes so assiduously and so long, our friend had been so impressed that he had seen fit to emphasise the fact that both over and underlying all other considerations was the powerful influence that they had for good over one's entire nature—physical, mental, and spiritual alike. No one surely could visit these tree-clad heights without feeling that he was a better man, even did not its truth impose itself on others. This was not a mere sentimental consideration. In all ages and amongst all nations this interest attaching to mountain scenery, with which this National Park was so richly endowed, had been confessed. It was not for naught that the Greeks of old had selected Mount Olympus as the abode of their gods. In fact, discussing one's frugal meal in company with the lecturer on some lofty eminence with New South Wales some thousands of feet below, the air meanwhile vocal with the songs of the lyre-bird and other forest denizens, and beauty meeting every outlook, one had felt indeed that he were attending some banquet of Jupiter and the other gods his associates, graced with Ganymede and Hebe in attendance, whilst meanwhile the Nine Muses under the leadership of Apollo poured forth their sweetest melodies, and Helios benignly shone o'er all.

The National Park, however, historically, too, was of unique interest, for it was a piece of land just as Nature had given us it, that had, as we had good reason to conclude—adopting the views of A. R. Wallace (*vid.* "Island Life")—survived the wreck of ages since when, in palæozoic and through secondary geological time, it had formed part of a great elongated territory, conterminous in fact with what is now the eastern cordillera of Queensland, and that had embraced in a single territory, not only Papua, but far-off New Zealand, now separated off by a submerged oceanic plateau—lying but 1,000 fathoms beneath the sea's surface—that, embracing New Caledonia, passed then between the Dominion and us.

Hence it was that he had recognised, aided by the light with which a botanical confrère had illuminated his inquiry, that there were still to be seen, growing on the higher lands of the reservation, some plants of ancient lineage that had their living counterparts on the great continental island mentioned, as suggestive of the fact that not only the rocks but even in part the vegetation had survived since long, long ago.

Amongst these were representatives of the plant-genera *Fagus, Rubus, Drimys, Weinmannia, Panax, Muhlenbeckia, Rhipipogon,* and *Lomaria.* Amongst these was especially to be noted the *Fagus Moorei,** that apart from its being a survival of a formerly generally spread genus that now persists in widely separated isolated areas extending from pole to pole, had remarkable physiognomical peculiarities—peculiarities that, born of its power to resist the battering of time—had been dwelt upon by the lecturer. The interest of this tree, and of its occurrence in the National Park, may be concluded from the fact that when formerly it was first discovered growing on the Macpherson Range, the late Sir F. von Mueller, the famous botanist, thought fit to make a special announcement to the Queensland Royal Society that he (the speaker) had been charged to deliver. The comparatively few surviving individuals are amongst the most interesting trees in the world, comparing in this respect with the ancient dragon-tree of Teneriffe described by A. Humboldt: they, by their hardiness alone, escaping the fate to which it has succumbed. Every existing tree should, he said, be listed and individually cared for. Of course, the ancient plants were not generally individually numerous, and further research might bring to light amidst the predominant vegetation many others of southern origin. Of one of the two tree-ferns growing on the summit of the range even botanical specimens had not yet been brought to Brisbane.

There were grounds, too, for concluding that the bird-life was similarly strangely interesting; and that, when it was elucidated, the Queensland lyre-bird —Prince Albert's *Menura*—a bird that lent itself so readily to extermination from this its home—would not be the only wonder of the world's avifauna that it possessed.

The geology of the National Park was a *terra incognita,* and the only light on the striking physiography of the region was that reflected by the photo. prints that the lecturer had himself secured.

When it was announced by the lecturer that this 47,000 acres—including the former Lamington Plateau reserve of 4,350 acres—had been proclaimed a National Park, he felt that it would be well that we were authoritatively assured what was meant by this and in what respect it was national. For most certainly (in his estimation) this territory should, as the effect of this proclamation, be constituted a heritage for Queensland people for all time, and if need be, to this end also, vested in persons charged with its maintenance and preservation. In fact, it should be "a preserve" as well as "a reserve," such preservation having reference not only to its integrity but to the safe-guarding its flora and its fauna from spoliation and destruction; much less should it be liable to alienation or any less disturbance of property rights at the will of any Ministry of the day. This necessity with respect to this region, so interesting from every point that had been advanced, would appear to anyone who could look back a quarter of a century or more and so regard the happenings with regard to land reservations in Queensland that had been made for one purpose or another.

To illustrate this again, too, he might recall the history of the National Park of Victoria—Wilson's Promontory—during the period 1886, when it was

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* Mr. Lahey was not quite correct in stating that this *Fagus* was thus identical with any one of the New Zealand "Beeches," but it was a congener with them.

first talked of, until 1905, when it was ultimately permanently devoted to its present uses, but only when the strongest pressure was brought on the Government of the day by the different scientific and other local societies, and when it had already been thrown open in 1,000-acre blocks for leasehold occupation.

He had also mentioned our obligation to secure the preservation of its flora and its fauna from the effects of firearm, dog, and trap, and from the operation of axe and fire, and the vandalism and destructive propensity of the man generally who delighted in a bush conflagration. In the case of the Wilson's Promontory National Park, it had already, in 1895, been declared an offence under the Game Act (Victoria) to kill any animal thereon with the exception of snakes. It would appear that this matter of securing the preservation of the National Park as a heritage of the people for all time should be a matter of consideration with the different societies, who, at the instance of the Geographical Society of Australasia (Queensland), might be brought into line for this purpose. [Seeing that a native of Queensland had done so much in securing us again in the possession of this important National Park, the Queensland Australian Natives' Association might be invited to co-operate (after-thought).—H.T.]

He would also dwell upon the necessity of ascertaining and making known in detail the geological, physiographical, topographical, and climatic features of the region, as well as of elucidating both the flora and fauna. Even it might, it was thought, afford information regarding the past history of our disappearing or already lost black race, as he had found blacks' implements in a cave between the heads of the Nerang and Coomera Rivers, and the principal eminences still bore the names these despised people had bestowed upon them. This would be taking stock only of this our Asset. It would add to public interest in the region now unknown to the dweller fifty miles away. True, the lecturer had thrown much light on many of its more beautiful scenic effects; but as he had told us, when taking the photographs with which he has delighted us, it was merely to acquire some memento of scenes that had charmed him; but when we looked into any other feature generally that contributed to the interest of this National Park, we very soon came to the region of the unknown. Even with regard to the Prince Albert's lyre-bird (*Menura Alberti*) itself and the habits that characterised it, the only account given us—*i.e.*, that from the pen of the ornithologist, the late S. Diggles (Qld. Phil. Soc., Jan., 1874)—had been regarded " as altogether too speculative and improbable" for reproduction (A. J. Campbell).

Mr. Tryon then went on to indicate briefly what had been accomplished in effecting a natural history survey in national, or what were virtually national, parks in other countries he had visited, notably South Africa, Honolulu, New Zealand, and the West Indies; and also alluded to the botanical survey of the Wilson's Promontory National Park that had been conducted during several years under the direction of Professor Ewart. He also added that he had one fault to find with Sergeant Lahey. He had understood him to refer to the elevated region embraced in the proclamation as the " Blue Mountains" of Queensland, although as suggestive—it would appear—only of the future estimation in which this National Park would be held when viewed from the standpoints that bestowed such notoriety on Sydney's great hinterland. However, having visited both the Blue Mountains and the National Park of

South Queensland, the points of comparison were not very close, the gain being evidently on the side of our mountain's region. Certainly it had nothing of "blue" about it, however. Its predominant feature was its almost continuous verdant vestiture and its beautiful and varied development of aboreal growth, broken only by the fretted escarpments of rock-exposures or the foaming waterfall or rivulet. Wherefore, he might have more appropriately termed the region the Green Mounts or Emerald Land.

But he had unduly trespassed on the patience of the meeting, for which he craved His Excellency's indulgence, and would conclude by proposing that a hearty vote of thanks be accorded Sergeant Lahey for his interesting address.

This was seconded by Mr. P. J. NALLY, supported by Dr. J. P. THOMSON, who spoke from early personal knowledge of the locality; and carried unanimously.

His Excellency the PRESIDENT, in conveying this resolution to Sergeant Lahey, warmly complimented him on the important outcome of his efforts; and, moreover, assured the meeting that, as President of the Society, he would undertake that action would be taken by it on the lines the speakers had recommended for preserving the National Park to the people of Queensland.

The following notes on the National Park, by Dr. H. C. RICHARDS and Dr. J. SHIRLEY, were contributed to a public meeting, held at the rooms of the Royal Geographical Society on the 20th March, 1916, and are herein included for fuller information:—

Dr. H. C. RICHARDS stated that he felt much honoured in being asked to speak. Before going any further, he desired to congratulate the Government on their grand action in proclaiming this area of approximately 50,000 acres a National Park; he also desired to extend congratulations to Sergeant Lahey on the reward obtained for the arduous work he carried out in thoroughly investigating the area and pressing so hard for this reservation. He understood that, while Dr. Thomson and others had worked on this matter many years ago, Lieutenant Lahey had done a tremendous amount recently.

With respect to the reserved area, he intimated that he had scrambled and worked geologically over a considerable portion of it, and therefore knew it rather well, particularly its ruggedness, which character, however, gave it great charm. The whole area is dissected by numerous gorges, and the head-waters of several rivers occur here. Nearly every creek has its falls, and these falls in many cases are several hundreds of feet high. The streams on the plateaux fall over these falls into the gorges below, and they are really very beautiful. The surfaces of the Lamington and Roberts Plateaux are not in any sense level, but there is considerable relief of the surface, which is usually heavily clothed with vegetation. While the plateaux have rather precipitous borders, the fall on the New South Wales side is very sheer for the most part, and from the top of the precipice panoramic views of great beauty over the valleys of the Richmond and Tweed Rivers, with the massive and grand Mount Warning forming a fine central background, are to be seen.

The geological structure of the area is most interesting, for it consists of accumulations of volcanic material upon the underlying sedimentary and metamorphic rocks. As far as we know, the base consists of the so-called Brisbane Schists of Palæozoic age; on these lie the coal-bearing series of rocks of much the same age as the Ipswich coal-measures. Resting on top of

these latter measures are the volcanic rocks. These volcanic rocks have a threefold development, the lowest division consisting of rather basic, dark-looking volcanic rocks known as basalts and andesites, and having an average thickness of 100 feet. The middle division is made up of acid volcanic material, sometimes as a loosely aggregated ash forming a tuff and sometimes as a rhyolite; this has an average thickness of 500 feet. The upper division consists of somewhat similar rocks to the lower division, but is much thicker and it has an average thickness of about 1,000 feet. The upper division is made up of many flows, each several feet thick and generally arranged horizontally. The loose friable material of the middle division is easily weathered away, and so the hard, weather-resisting rocks of the upper division are undermined, with the result that they break away, forming rather precipitous edges to the plateaux, and the successive flows stand out as definite ledges.

As far as accessibility to the Lamington Plateau is concerned, the approach from Walsh's selection on Christmas Creek appears to be the easiest one, and a road with quite reasonable grades could be made from there.

A comparison of this area with that of the Blue Mountains area in New South Wales has been made, and one might say that all the charms the Blue Mountains area possesses, this one has, and in addition it has the wonderful vegetation. With respect to the Kosciusko region of New South Wales and the Buffalo region of Victoria, the great differences between these types of country and this one make it rather impossible to enter upon a comparison.

Dr. John Shirley said: The great reserve, formed by the present Government of Queensland, promises to be for this State what the reserve at Wilson's Promontory is to Victoria, a sanctuary for rare plants and rarer animals. Of 225 species or well-marked varieties of Queensland ferns no less than 100 kinds are found in the Park. These include northern forms like *Trichomanes*, and southern ones such as *Aspidium capense* and *A. aristatum*. This mixture of forms, far distant from their centre of distribution, is a marked feature of the scrubs near the Macpherson Range.

The Lamington Plateau supplies our only true beech, *Fagus Moorei*, the plant known to timber-getters as beech belonging to a wholly different family. A tree, *Endiandra insignis*, discovered by Mr. J. F. Bailey on the Russell River, is now known to be one of the commonest inhabitants of scrubs on the Logan, Coomera, and Nerang Creeks, although not reported from any intermediate locality. The Chinese rice-cloth plant, *Boehmeria*, is found in two separate species on the Johnstone River and at the Reserve, and only at these places. Among beautiful flowering trees restricted to South Queensland are *Daviesia arborea* with its yellow and red pea-flowers, and *Leucosmia Chermsideana* covered in scented bells of a pale-yellow colour. Mount Lindsay is noted for two rare trees of the silky-oak family, *Grevillea circiifolia* and *Lomatia ilicifolia*. The zamia so much admired by visitors to our southern mountains, *Macrozamia Denisoni*, is also peculiar to the locality, and the scrubs supply many beautiful orchids, especially of the genera *Dendrobium, Bulbophyllum*, and *Sarcochilus*.

ANNIVERSARY ADDRESS TO THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

By His Excellency Major Sir HAMILTON J. GOOLD-ADAMS, G.C.M.G., C.B. F.R.G.S., Etc., Etc., President.*

Fellows and Members of this Society,—

Permit me to thank you for the honour which you have done me in asking that I should continue to be your President during the forthcoming year. I accept that distinguished position, and shall endeavour during my term of office to advance the interests of your Society to the best of my ability.

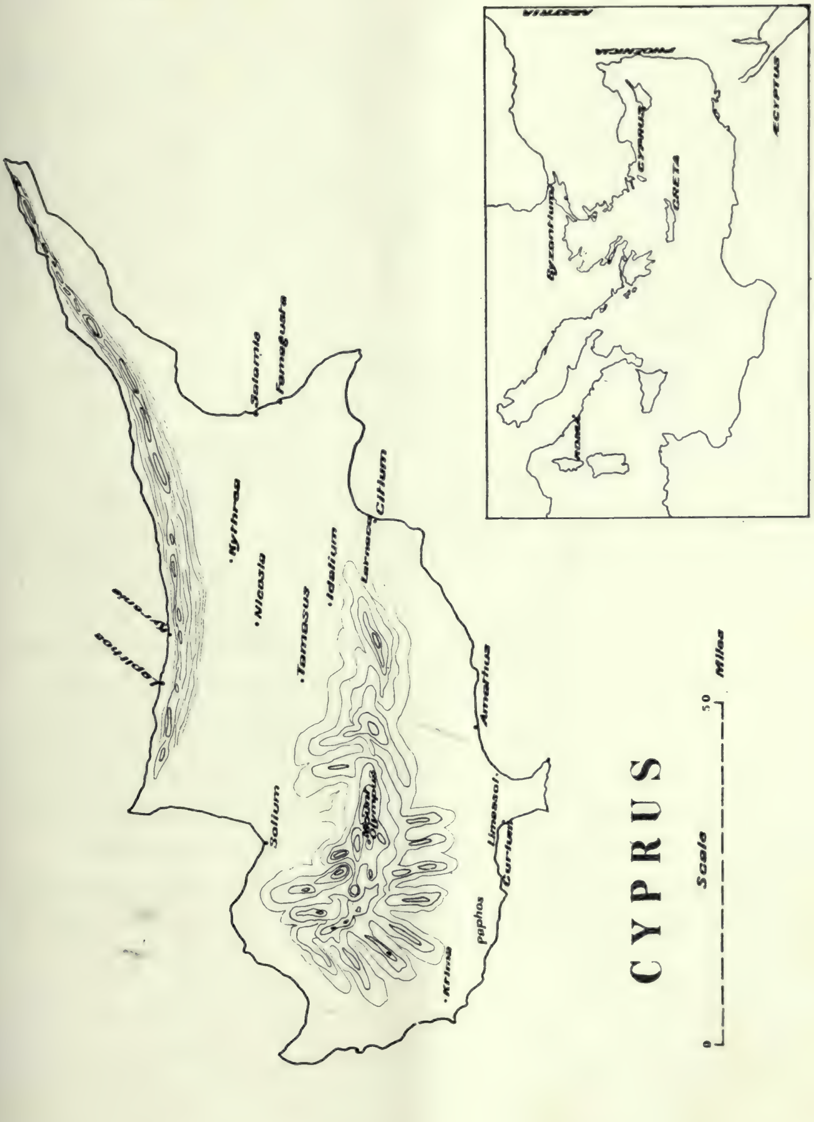
Since taking up my duties as President of this Society I have met with the most cordial assistance from the members of the Council, and its hard-working and conscientious Honorary Secretary, Dr. Thomson, and I take this opportunity of thanking them for all that they have done during the past year. I feel sure that the same interest will be taken by them in the work of the Society during the forthcoming twelve months; and should I find it impossible to devote quite as much of my time to our joint work, I trust that they will realise it will probably be due to inability rather than want of a desire to assist them.

There are two minor matters connected with the work of the Council which have not been mentioned in the Report, but to which I desire to allude; they have both been receiving a good deal of attention from the members of the Council, and I hope something may be done to bring them to fruition.

The first relates to the binding of some of our more valuable possessions in the library, in order to make them handier for perusal as well as to preserve the editions from the results of wear.

The second is the compilation of a catalogue of our library on the same lines as suggested by the Royal Society of Queensland for all the scientific libraries in Brisbane; and I hope that the donation of £10 which I have personally made may enable this much-needed work, so far as our library is concerned, to be accomplished before long.

* Royal Geo. Socy. of Asa., Qland, August 22, 1916.


CYPRUS
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Larnaca
Citium
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Limassol
Curium
paphos
Byzantium
CYPRUS
CRETA
PHOENICIA
ASSYRIA
EGYPTUS
ROMA

Some short time ago I was the guest of the Royal Society of Queensland at its annual meeting, and I had the pleasure of listening to a most interesting and instructive lecture given by the out-going President, Dr. Harvey Johnston, as his valedictory address.

I have to confess that the standard set by Dr. Johnston on that occasion for a Presidential Address truly caused me to shudder, as I felt how impossible it would be for me, when the time arrived for me to address the Fellows and Members of this Society, to discourse in a wide scientific manner on matters of a geographical nature. I accordingly propose to-night to abandon the principle of Dr. Harvey Johnston, and give you a very brief account of that latest of British Colonies, The Island of Cyprus, which Mallock has described as " The Enchanted Island."

Cyprus is an island in the Mediterranean, distant about 40 miles from the coast of Asia Minor, and 60 miles from Syria. It is the third largest island in the Mediterranean, its area being 3,584 square miles (approximately as large as the country from North Pine to Tweed Heads, and back as far as the range below Toowoomba). Its greatest length is 160 miles and it greatest breadth 60 miles. It has been likened by the ancients to a skin pegged out to dry.

It has two mountain ranges, the one running parallel and close to the north coast consisting of a narrow razor-backed series of hills up to 3,100 ft. in height. The other and more extensive range occupies a larger portion of the southern half of the island, its highest point being Mount Troodos, 6,406 ft. above sea-level. This mountain also is called Mount Olympus, but must not be confounded with the better known Olympus in Peloponnesia.

The Island has few rivers, they being little more than mountain torrents, with rough and stony beds, dry in summer and unnavigable in winter. The coastline is broken by many bays, which were admirably adapted to ancient sailing vessels but do not lend themselves to use by large modern steamers.

Set in the Eastern Mediterranean between such Empires as Assyria, Carthage, Rome, Egypt, and Byzantium, Cyprus seems to have been destined by nature to be the battlefield of the near East and the prey of contending faiths and rival powers.

The first definite history of Cyprus begins in 569 B.C., when

Amasis, King of Egypt, conquered the Island and made it pay him tribute. For nearly 2,500 years therefore we have a complete record of all that has taken place in the Island.

Though no definite history of the Island exists prior to 569 B.C., yet there are many incidents connected with it which we do know. From the examination of tombs, especially those carried out during my stay in Cyprus by Professor J. L. Myers, of Oxford, assisted by Mr. Dudley Buxton, we know that as early as 3500 B.C. the inhabitants of the Island were already of a very mixed character. In the early bronze age necropolis, found by Professor Myers near Lapithos, skulls of different races were found, including Nubians, Sudanese, Mongolians, and skulls with the prominent foreheads of Western Europe, thus showing that Cyprus in those early times was a meeting-place of many peoples and thus a place of importance. Herodotus mentions that the population of Cyprus in earlier days consisted partly of Ethiopians, and this statement is more or less confirmed by our recent excavations. We know that Thotmes III., the Egyptian monarch of the 18th dynasty, conquered the Island in 1450 B.C. It is also known that the Phœnicians, who occupied the shores of Syria from about 2000 B.C., exercised influence in Cyprus for a very long period. Cyprus came under the domination of Assyria in the 9th century before Christ, and remained so until taken by the Egyptians in 569.

The authentic history of Cyprus tells us that the Cypriots joined forces with Cambyses, the Persian, when he conquered Egypt in 525 B.C. The Island then, in combination with Phœnicia and Syria, formed the 5th Persian Satrapy. In 502, the Ionians revolted against Persia and induced the Cypriots to do so also, but their efforts were ineffectual. During the subsequent wars between the Greeks and the Persians, Cyprus was often the scene of hostilities. Eventually the Persians were overthrown by Alexander the Great in 332 B.C. After the death of Alexander, in 321, his two generals, Antigonus and Ptolemy, fought each other for the possession of his Eastern dominion, Ptolemy seizing Egypt and eventually seizing Cyprus in 306. The Island remained under the Ptolemaic rule until taken possession of by the Romans in 60 B.C.

Cæsar gave the Island back to Ptolemy, the brother of Cleopatra, but Augustus Cæsar in B.C. 22 revoked the gift. Cyprus remained under the Romans until 395 A.D., when it was transferred to the Emperors in Constantinople. It remained so until 1184,

when the Government was seized by Isaac Commenos, the Byzantine Duke of the Island. Richard I. of England, on his way to take part in the 3rd Crusade, took it in 1191 from Isaac, and sold it to the Knight Templars; but owing to their mismanaging the affairs, Richard resumed possession and sold it again to Guy de Lusignan after the latter was deprived of the Kingdom of Jerusalem by Saladin.

In 1372 the Genoese seized the town of Famagusta and held it for about fifty years.

The last Lusignan King of Cyprus married a Venetian lady named Catherine Connaro in 1470, and after his death she abdicated, in 1488, in favour of the Venetian Republic.

The three hundred years during which it was ruled by the Lusignans were the most brilliant epoch in the varied history of Cyprus. It played a distinguished part in mediæval civilization, and was invested with an importance amongst the nations of Europe wholly out of proportion to its size and population.

The town of Famagusta was noted for its wealth and splendour, especially in the 14th century, and its courtesans set a fashion amongst the ladies of those times much as Paris does at the present time. Cyprus can boast of beautiful examples of mediæval architecture in the still existing Abbey of Bella Paise, the Cathedrals of Nicosia and Famagusta, and the castles of St. Hilarion, Buffaventa, and Kantara.

The Government of Venice lasted 82 years until 1571, when it was taken by the Turks after a magnificent defence of four months of the town of Famagusta.

In 1878 the administration of the Island was handed over to Great Britain, and in October, 1914, it was annexed as a Colony by Great Britain, and I had the honour of hoisting the Union Jack as its first British Governor.

It has been stated that Homer was born in Cyprus. We know that the philosopher Zeno was born there in 362 B.C. It was visited by the Empress Helena, mother of Constantine the Great, and she founded a chapel there in which she deposited a piece of the true Cross.

In 115 A.D., during the reign of the Emperor Trajan, the Jews in the Island massacred 250,000 inhabitants and were then banished by the Emperor.

The Arabs on three occasions tried to seize the Island—viz., in 648 A.D., 803 A.D., and 964 A.D., but were never successful in holding it.

The foregoing is a very brief outline of the history of the Island which time will not permit me to enlarge. I will now proceed to show you a few lantern slides showing places and things connected with the Island, and briefly explain as I go along.

[His Excellency the President then proceeded to show the audience something of the arts, and also something of the interior of the island. There was unfolded not merely a series of pictures, but an insight was given into the progress of man throughout the ages. The words of the lecturer opened new vistas of thought. First were shown crudely-fashioned vessels, as though of an ignorant people groping their way towards the rudiments of culture. Then gradually the vessels became more shapely, with finer decorations of filigree work, and somewhat crude representations of birds and animals. A large jar, of which Sir Hamilton Goold-Adams is the proud possessor, is ornamented with lotus flowers and Assyrian roses.

The skill and patience of ancient and mediæval craftsmen and artists has ever caused modern man to wonder. The Eastern vegetable dyes and Persian rugs have never since been equalled; and a remarkable illustration was given by the lecturer of seals, carved in agate or some other hard substance, which are found in very large numbers in the Cyprian tombs. One specimen was only the size of a sixpenny-bit, yet was a perfect representation of a woman gazing into a looking-glass, with details so fine that a magnifying glass was necessary to properly discern them. The picture was also shown of a great granite vase weighing between 50 and 60 tons.

The growth and development of the people was equally portrayed in the architecture of the Island. Some of the temples had a most extraordinary history, of construction, demolition, and reconstruction, while the ancient castles were built mostly on almost inaccessible peaks. In the case of a massive stone structure, containing 100 rooms, the material for its construction had to be carried up precipitous mountains for a distance of 2,500 ft. In such castles a clear representation of the social life of the time is preserved. They tell the story of constant warfare and danger, of insecurity of life, of an absence of all the ease and leisure enjoyed in modern times. Apart from the inconvenience and mismanagement arising from the cheap and nasty habits of our commercial life, modern society is at liberty to select positions and erect dwellings of utility and beauty. Those ancient buildings were not beautiful, they were not convenient, but they were almost unapproachable by foes from without. They remind us of a social order of warrior chiefs and predatory bands, with hordes of driven slaves carrying building material 2,500 ft. to a mountain top. As elsewhere is Europe, examples of the wonderful architecture of mediæval times are preserved. The thousand years after the fall of the Roman Empire was remarkable for the acquisition in Europe of the highest skill in design and craftsmanship. The Cathedral of Rheims belongs to that period, as well as

most of the most beautiful Gothic structures. Cyprus is noteworthy for many temples and sacred buildings of that epoch, some of which preserve specimens of the most beautiful stonework on record.

It was not generally known, remarked the lecturer, that the scene of Shakespeare's drama, ''Othello,'' was in Cyprus. Othello's true name was supposed to have been Elmora. He was not a black man at all. A view of the entrance to his castle was screened. General views of the physical characteristics of the island were then shown, while the lecturer spoke interestingly of his endeavours to save from vandalism the valuable examples of ancient architecture.—Ed. '' Q.G.J.'']

Mr. A. W. CAMERON proposed a hearty vote of thanks to His Excellency the President for his most instructive and interesting lecture. The Society was very fortunate in having a gentleman of His Excellency's ability, and one who takes such a keen interest in Historical Research, as its President. Without doubt, the improvement in the Society during the year, mentioned in the report, is due in a great measure to the interest taken, and the time given, by His Excellency to the conduct of its affairs.* The Island of Cyprus has been so prominently before the public from ancient and modern times, that we thought we knew a great deal about it; but after hearing His Excelleny's address, no doubt we would conclude that we knew little more than the name. Now it will have a greater interest for us and we will all watch for any event happening in the Island.

Dr. the Hon. W. F. TAYLOR, in seconding the motion for a vote of thanks to his Excellency the President for his address, referred to the keen interest which he had taken in the affairs of the Society during the past year, and expressed his pleasure at His Excellency having consented to continue his occupancy of the Presidential chair, and congratulated the members of the Society at again having His Excelleny's great ability and experience at their disposal. He desired to compliment His Excellency on the very admirable address with which he had favoured the meeting, and expressed his wonder at the marvellous memory for dates and events which His Excellency had shown in dealing with ''The History of Cyprus from the Earliest Times.'' Although His Excellency had stated that he might not be able to devote as much time to the affairs of the Society in the future as he had during the past, he (Dr. Taylor) was sure that the great interest which he had hitherto shown in the welfare of the Royal Geographical Society would not diminish.

Mr. A. S. KENNEDY said that he desired to support the motion which had

* It is felt that this view will be fully endorsed by the Members of the Society at large. The active and practical interest at all times evinced by His Excellency the President in the affairs of the Society has been an inspiration to the Officers and Council, rendering their duties agreeable and light, as well as being a stimulating example to friends and supporters alike. At all the meetings the President's wide knowledge and experience have contributed in no small measure to their success—a marked feature in the Sessional programme—and it is undoubtedly a most fortunate circumstance to have as the honoured head of the Society, a worker and, moreover, a gentleman so distinguished as an Explorer, Scientific Geographer, Traveller, and Administrator, and one whose practical interest in the welfare of the Society is so fully shared by Lady Goold-Adams.—[Hon. Sec. and Treas. R.G.S.A.Q.]

been so ably proposed and seconded. He did so as a very old member of the Society, who, from various causes, had been unable to attend any of its meetings for several years, but who took a deep interest in its welfare; it was therefore particularly gratifying to learn on this the first occasion of resuming his attendance, that the Society was in such a prosperous condition as the report read that evening showed it to be; and there was the additional gratification of having the privilege of listening to the very instructive and highly interesting address with which they had been favoured by His Excellency. He was sure that in saying that he had listened to the address with pleasure and profit, he was very inadequately expressing the feelings of all present. For this reason, and quite apart from any other consideration, he supported very heartily and sincerely the vote of thanks to His Excellency.

The motion was carried by acclamation.

In responding His Excellency the President promised to further the interests of the Society in every possible way.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

Thirtieth Annual General Meeting, 30th July, 1915.

The meeting was opened by the Hon. W. F. Taylor, M.D., M.L.C., Vice-President of the Society, who stated that, in response to the invitation of the Council, His Excellency Major Sir Hamilton J. Goold-Adams, G.C.M.G., C.B., F.R.G.S., had been pleased to accept the position of President of the Society. He moved that the action of the Council be confirmed. The motion was carried by acclamation.

His Excellency the new President then took the chair amidst applause and received the congratulations of the retiring chairman.

The attendance was large.

The minutes of the previous monthly meeting were taken as read, and duly confirmed.

The Hon. Secretary and Treasurer read a telegram from His Excellency the Governor-General, Right Honourable Sir Ronald C. Munro-Ferguson, P.C., G.C.M.G., LL.D., accepting the position of Patron of the Society.

Communications were read from the Right Honourable Andrew Fisher, P.C. (Prime Minister), Mrs. Lumley Hill, and Hon. J. W. Blair (President), regretting unavoidable absence from the meeting.

The Hon. Secretary and Treasurer (Dr. J. P. Thomson) read the Annual Report of the Council, and submitted the financial statements, duly audited, all of which were adopted, on the motion of Dr. H. C. Shaw, supported by His Excellency the President and Mr. E. C. Barton.

Professor A. J. Gibson then delivered an address on the "Manufacture of Munitions." The vote of thanks to the lecturer for his address was moved by His Excellency the President and carried by acclamation.

The following officers and council were elected:—

OFFICERS AND COUNCIL NOMINATED FOR SESSION 1915-16.

Vice-Presidents:

Hon. J. W. Blair. Edgar W. Walker, Esq., J.P.

Honorary Secretary and Treasurer:

Dr. J. P. Thomson.

Other Members of the Council:

James Stodart, Esq., M.L.A.
B. Dunstan, Esq., F.G.S.
Alderman A. McLeod, J.P.
L. H. Spence, Esq., J.P.
W. M. L'Estrange, Esq., A.M.I.E.E.
Captain Ch. Sankey Fraser, J.P.
J. P. Wilson, Esq., J.P.
Alexr. Corrie, Esq. (Fellow).

Report of Council, Thirtieth Session, 1914-1915.

The Council has the honour of submitting to the Fellows and Members the Thirtieth Annual Report on the activities of the Society, for the financial year ending the 30th June, 1915.

In thus briefly alluding to the work of the session it is gratifying to be able to refer to the growth of the Society at large, as indicated by the substantial increase of sixteen new members to the roll, including their Excellencies the Governor-General of the Commonwealth and the State Governor, the latter of whom we have the honour of welcoming here as our President, as well as by the satisfactory position of the vested funds and current accounts. It is, indeed, a matter of much gratification to find that the affairs of the Society are so prosperous at such a critical time in the history of the world at large, when all public and private resources are so heavily taxed, and even the welfare of the Empire itself is at stake.

On this occasion regretful reference has to be made to the losses sustained by the passing away of three greatly valued members of the Society, Messrs. J. F. Fitzgerald, D. W. McLeod, and T. S. Sword, whom death has removed from the roll of active supporters; the last-named gentleman being one of the earliest subscribers, a former valued member of the Council, and a high State official. In the case of Mr. Fitzgerald, the Society has lost a warm friend and one who, as senior member of a well-known city legal firm, had rendered useful service in the position of Honorary Solicitor for several years. It is, however, gratifying to know that the firm will continue to act for the Society as formerly.

By the Financial Statement herewith submitted it will readily be seen that the general funds of the Society are in a satisfactory condition. The Thomson Foundation Medal Fund, having now become an accomplished fact, is self supporting, as indicated by the accompanying Balance-sheet, and the Council is thereby in the happy position of being able to make an award of the Gold Medal annually, as at first intended, to the best original contribution to Geographical Literature approved and accepted, or to such persons as may have rendered signal service to the Society. The subjects named as being acceptable for competition by authors desirous of gaining the medal are:—

To be sent in not later than 1*st June,* 1916.

1. The Underground Waters of Queensland; or
2. The Conservation of Water—Losses from Reservoirs through Leakage, Closing up Effect of Silt Deposits, Evaporation, &c.; or
3. The Settlement of Tropical Australia; or
4. How we may most rapidly populate Australia.

To be sent in not later than 1*st June,* 1917.

1. The less Settled Regions of South Australia and West Australia: their Relief, Drainage, and Explorations since 1880; or
2. A Workable Scheme for the Most Economic Method of Handling Queensland Valuable Timbers; or
3. The Economic Utility and Distribution of Queensland Timbers.

As formerly, the Library has been enriched by many valuable additions, including exchanges from kindred sources and Government departments, all of which are available to the members at any time. In consequence of the disturbed state of the countries involved in the war, there has been a marked falling off in the number of European exchanges, especially those usually received from Russia, France, Germany, Austria, and Belgium.

The work of the session comprised the reading and discussion of some popular papers, with lantern slide pictures, as follows:—"Some Cities of Europe, their beauty as an Investment, their Traffic and Housing Problems," by Mr. E. C. Barton, F.R.G.S.; "The Artesian Waters of Queensland," by Professor J. W. Gregory, D.Sc., F.R.S.; "Through Darkest Africa with Bible and Camera, Knapsack and Gun," by Mr. Dan Crawford, F.R.G.S.; "About Torres Strait with Camera," by Mr. J. W. Davidson; "Britain's newly-acquired South Sea Island Possessions, including New Guinea," by Dr. J. P. Thomson; "The Land of the Rising Sun," by the Rev. James Cosh, B.A., B.D.; "French and British: Foes a hundred years ago, Allies now," by the Hon. F. T. Brentnall, M.L.C. To the authors of these valuable contributions the thanks of the Council are due.

In accordance with former procedure, the Council has pleasure in recommending:—

(1) The suspension of so much of the "Rules" as provides for the payment of an entrance fee.

(2) The reappointment of Mr. Robert Fraser as Hon. Auditor, and the appointment of Mr. C. J. Pound as Acting Hon. Lanternist, and Miss Ada Thomson as Acting Hon. Librarian.

(3) The reappointment of Sir Arthur Morgan, Messrs. Robert Fraser, and Alexander Muir, and the appointment of the Hon. F. T. Brentnall as Hon. Members of the Council.

It is also recommended that Mr. George Phillips, C.E., formerly Vice-President of the Society, and greatly valued contributor to its literature, for some time an active member of the Council, a worthy recipient of the Diploma of Fellowship, Trustee of the Thomson Foundation Medal Fund, and a Pioneer Queenslander, be transferred to the Roll of Honorary Members.

While cordially thanking all contributors to the successful work of the session the Council would especially acknowledge the valuable services rendered by Messrs. Robert Fraser, Hon. Auditor; H. W. Mobsby, Hon. Lanternist, and C. J. Pound, who has kindly acted as Hon. Lanternist in Mr. Mobsby's absence at the Panama Pacific Exhibition, San Francisco.

THE THOMSON FOUNDATION MEDAL FUND. BALANCE-SHEET AS AT 30TH JUNE, 1915.

Liabilities.	£ s. d.	£ s. d.	Assets.	£ s. d.
The Thomson Foundation Medal Fund	..	300 0 0	Royal Bank, Preference Shares	300 0 0
Medal Fund, Revenue Account ..	1 3 11		Government Savings Bank	17 10 5
Add Surplus, 1914-1915	16 6 6			
		17 10 5		
		£317 10 5		£317 10 5

Examined and found correct.

R. FRASER, Hon. Auditor.

10th July, 1915.

ARTHUR MORGAN,
GEO. PHILLIPS,
J. P. THOMSON } Trustees.

STATEMENT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND, FROM 1st JULY, 1914, TO 30th JUNE, 1915.

Dr.	£ s. d.	£ s. d.
By Funds at close of last Account—		
,, Balance in Government Savings Bank	9 6 10	
,, Balance in Royal Bank ..	97 1 11	
		106 8 9
,, Subscriptions received		178 15 6
,, Interest on Government Savings Bank deposit		2 15 6
		£287 19 9

Cr.	£ s. d.	£ s. d.
To Expenditure as per Accounts—		
,, Gas	1 13 5	
,, Fire insurance premiums ..	3 6 0	
,, General postage and printing ..	48 15 11	
		53 15 4
,, Advertising meetings	1 19 9	
,, Cleaning, &c.	17 13 0	
,, Expenses of meetings, refreshments, &c.	17 7 6	
,, Gas fixtures	2 8 5	
,, Typing and clerical	6 19 6	
,, Refund and sub. to British Association	2 1 0	
,, Incidentals	4 18 0	
		52 17 2
,, Stationery, books, slides, library, &c.	13 0 0	
,, Hon. Treasurer's account ..	50 0 0	
,, Petty cash	1 14 3	
		64 14 3
,, Exchanges and uncollected subscriptions	1 16 0	
,, Bank charges	0 10 0	
		2 6 0
,, Balance in Government Savings Bank	113 19 7	
,, Balance in Royal Bank ..	0 7 5	
		114 7 0
		£287 19 9

Examined with bank pass books, vouchers, &c., and found correct.
ROBT. FRASER, Hon. Auditor—10th July, 1915.

J. P. THOMSON, Hon. Sec. and Treas.—10th July, 1915.
Adopted 15th July, 1915. WILL. M. L'ESTRANGE.

Thirty-first Annual General Meeting, 22nd August, 1916.

His Excellency Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S., &c., President of the Society, in the chair.

There was a large and representative attendance, including Lady Goold-Adams.

The minutes of the previous monthly meeting of the Society were taken as read and duly confirmed.

Elections: Hon. Corresponding Member:—His Honour Dr. W. F. Frear, LL.D., Honolulu.

Members: His Grace the Most Rev. Archbishop Duhig, D.D.; Messrs. R. Cobden, A. Jones, senr., W. E. Irving, G. Goodman, W. F. S. Key, J. Peart, C.E., A. Mottershead, B.A., B.Sc., and T. C. Troedson.

The Hon. Secretary and Treasurer (Dr. J. P. Thomson) read the Annual Report of the Council and submitted the financial statement, duly audited. These were adopted on the motion of Mr. W. M. L'Estrange, seconded by Mr. James Stodart, M.L.A., and supported by Dr. the Hon. W. F. Taylor, M.L.C.

His Excellency the President then delivered his Anniversary Address, being "A Brief History of Cyprus from the Earliest Times," with Lantern Slides, screened by Mr. H. W. Mobsby, Hon. Lanternist. (*See* p. 88.)

The vote of thanks to His Excellency the President, for his interesting address, was moved by Mr. A. W. Cameron, seconded by Dr. the Hon. W. F. Taylor, M.L.C., supported by Mr. A. S. Kennedy, and carried by acclamation.

The following officers and Council were then elected for the session, 1916-17, the Patron and President having been appointed at the preceding Annual General Meeting:—

Vice-Presidents:

W. M. L'ESTRANGE, Esq., A.M.I.E.E., J. P. WILSON, Esq., J.P.

Hon. Secretary and Treasurer:

Dr. J. P. THOMSON.

Other Members of the Council:

JAMES STODART, Esq., M.L.A.
B. DUNSTAN, Esq., F.G.S.
H. D. MACROSSAN, Esq., B.A.
B. L. SCHOOLEY, Esq., C.E.
E. W. WALKER, Esq., J.P.
A. W. CAMERON, Esq., J.P.
J. A. FRASER, Esq., C.E.
Captain O. SVENSEN.

Report of Council, Thirty-first Session, 1915-16.

In submitting to the Fellows and Members of the Society the Thirty-first Annual Report, for the financial year ending on the 30th June, 1916, the Council feels gratified at the continued accessions to the Membership Roll, thirty-two new names having been added during the session, while the general finances are satisfactory, as shown by the statements hereto appended, including the Thomson Foundation Medal Fund, which, as stated in last year's report, is now self supporting.

It is with deep regret that allusion is here made to the loss sustained by the death of several greatly valued associates. These include Sir Clements R. Markham, a former distinguished Secretary and President of the Parent Society, London, and one of the greatest British Geographers of his time. He was a most voluminous contributor to geographical literature, and an active worker up to the close of his distinguished career. An esteemed supporter, he always endeavoured to further the interests of this Society.

Death has also claimed, as one of its most illustrious victims, Sir Sandford Fleming, the venerable Chancellor of Queen's University, Ontario, an eminent Canadian engineer, the pioneer of the Pacific Cable, author of the Zone system of universal time reckoning, Empire builder, and for many years an Honorary Correspondent of the Society, whose loss is widely deplored.

Death has also removed from the roll:—Mrs. B. C. Parr, an old resident of Warwick; Messrs. T. W. Connah, C. W. Costin, P. W. Crowe, James Dick, W. Gibson, Francis Parker, and E. M. Waraker, the two last named being Life Members of many years' standing; the late Mr. Waraker being, in point of fact, one of the oldest members, and always a warm supporter.

The Council has obtained from London the metal dies of the Society's Thomson Foundation Medal, which have been admitted free of duty by the Federal Authorities, at the request of our member, Mr. W. F. Finlayson, M.P., to whom thanks are due. Before sending for the dies the Trustees of the Medal Fund ascertained that the gold medal could be produced at the Royal Mint, Melbourne, the cost being less than in London, and there will be a saving of over £4 on each medal for Customs dues, &c. It will thus be seen that the transfer of the dies will be of great advantage to the Medal Fund, and help to facilitate the work of the Society considerably.

The subjects of literary competition for the Medal were mentioned in last year's report, and as usual will be published in the forthcoming issue of the "Journal," now passing through the Press.

Although affected by the present European War, the Library continues to grow in numbers that have already reached formidable proportions, requiring much attention and increased space. The works, being of great value, cover the entire field of scientific literature, and are available to members who desire to make use of the Library at all times.

The sessional work included the delivery of several interesting addresses, with lantern slide illustrations, on the following subjects:—

The Manufacture and Production of Munitions, by Professor A. J. Gibson, Assoc. M. Inst. C.E.

A Journey to South Central Africa, by His Excellency Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S., &c., President of the Society.

Some reasons why National Parks should be established in Queensland, with special reference to the Lamington National Park, by R. W. Lahey, B.E.

Some places I visited in America, including California, the Rocky Mountains, and Colorado, by C. J. Pound, F.R.M.S.

Queensland at the World's Fair—Panama Pacific International Exposition—San Francisco, U.S.A., by H. W. Mobsby, F.R.S.A.

Snapshots taken on Active Service with the Australian Expeditionary Forces, including Battle Scenes at Anzac, by Chaplain Colonel E. N. Merrington, M.A., Ph.D.

A 4,000-Mile Motor Tour through Queensland, by G. W. Whatmore.

To the authors of these communications cordial thanks are due.

In addition to the ordinary duties of the Society, comprising the reading of scientific papers and the discussion of popular scientific subjects, brought forward from time to time in the form of illustrated lectures, the co-operation of some of the local scientific and professional bodies was obtained to consider matters having reference to the control and development of the National Park. The movement, in passing out of the hands of this Society, culminated in a large and representative public meeting held on the 20th March, 1916, at which a vigilance committee was appointed, composed of an equal number of representatives of the public and the co-operating bodies.

Mention should also be made of the appointment, by His Excellency the Governor in Council, of our Hon. Secretary and Treasurer, Dr. J. P. Thomson, as representative of the Society on the Council of the University of Queensland.

Following on the lines of former procedure, it is presumed that the usual formal recommendations will meet with the approval of the Fellows and Members.

In conclusion, the Council has pleasure in acknowledging the valuable services of Mr. Robert Fraser, Hon. Auditor, who has been transferred to the Roll of Life Members, and Messrs. Mobsby and Pound, who have acted as Hon. Lanternists, thereby contributing in no small measure to the success of the monthly meetings.

THE THOMSON FOUNDATION MEDAL FUND. BALANCE-SHEET AS AT THE 30TH JUNE, 1916.

Liabilities.

	£	s.	d.	£	s.	d.
The Thomson Foundation Medal Fund				300	0	0
Balance in Government Savings Bank on 30th June, 1915 ..	17	10	5			
Deposits in Government Savings Bank, 1915-16	15	0	0			
	32	10	5			
Less £17 5s. 6d. for medal in stock	17	5	6			
	15	4	11			
Interest on Government Savings Bank Deposit	0	5	4			
				15	10	3
				£315	10	3

Assets.

	£	s.	d.	£	s.	d.
Royal Bank Preference Shares				300	0	0
Government Savings Bank				15	10	3
				£315	10	3

Examined with bank pass book, vouchers, &c., and found correct.
8th July, 1916.

J. P. THOMSON, Hon. Secy. and Treas.
ROBT. FRASER, Hon. Auditor.

STATEMENT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND, FROM 1st JULY, 1915, TO 30th JUNE, 1916.

Dr.

	£ s. d.	£ s. d.
By Funds at close of last Accounts—		
,, Balance in Government Savings Bank	113 19 7	
,, Balance in Royal Bank ..	0 7 5	
		114 7 0
,, Subscriptions received	..	181 11 2
,, Interest on Government Savings Bank deposit	1 19 2	
		£297 17 4

Cr.

	£ s. d.	£ s. d.
To Expenditure as per Accounts—		
,, Gas	1 1 2	
,, Fire insurance premiums ..	3 9 0	
,, Printing and general postage ..	105 19 8	
		110 9 10
,, Advertising meetings	3 18 3	
,, Cleaning, &c.	17 11 0	
,, Expenses of meetings and refreshments	26 2 2	
,, Repairs to furniture and hire of chairs	8 10 2	
,, Typing and clerical	4 4 7	
,, Incidentals	2 14 2	
,, Hon. Treasurer's Account ..	50 0 0	
,, Petty cash	0 10 3	
		113 10 7
,, Balance in Government Savings Bank	..	73 16 11
		£297 17 4

Submitted and approved—JAS. STODART, 19 July, 1916.

J. P. THOMSON, Hon. Sec. and Treasurer.
8th July, 1916.

Examined with bank pass book. vouchers, &c., and found correct.
ROBT. FRASER, Hon. Auditor.
8th July, 1916.

Royal Geographical Society of Australasia,

QUEENSLAND.

Founded 1885.

THE THOMSON FOUNDATION GOLD MEDAL.

Awards.

The Thomson Foundation Gold Medal of the Royal Geographical Society of Australasia, Queensland, established in 1900, in honour of Dr. J. P. Thomson, the Founder of the Society, shall be awarded annually, or at such other times as the Council may approve, to the author of the best original contribution to Geographical Literature, provided it be of sufficient merit, approved and accepted by the Council. Special awards of the Medal may also be made from time to time to such persons as have gratuitously rendered eminent services to the Society.

The following are the names of the recipients of the Medal, the grounds of the award being noted only briefly here, but are given more fully in the "Journal," to which reference is hereafter made:—

1901—**Dr. J. P. Thomson**—for his great services to Geographical Science. *Vide Queensland Geographical Journal,* vol. xv., pp. 133-134; vol. xvi., pp. 132-135, 141-142.

1906—**Sir Hugh M. Nelson**—for his valuable services to the Society, *Vide Queensland Geographical Journal,* vol. xxi., p. 151.

1910—**Sir Arthur Morgan**—for valuable services rendered to the Society, *Vide Queensland Geographical Journal,* vol. xxv., p. 144.

Diplomas of Fellowship.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 3, Constitution and Rules (*See page 2 of Cover*) :—

Honorary :

The Right Hon. Sir William MacGregor, P.C., G.C.M.G., C.B., M.D., LL.D., D.Sc., Hon. F.R.G.S., &c.

The Right Hon. Lord Lamington, P.C., G.C.M.G., G.C.I.E., B.A., F.R.G.S., Hon. F.R.S.G.S., &c.

The Right Hon. Sir. S. W. Griffith, P.C., G.C.M.G., M.A., &c.

Professor J. W. Gregory, D.Sc., F.R.S., Geological Department, University, Glasgow, Scotland.

Under subsections (a and b) :—

Charles Battersby, Esq., J.P.
Robert Fraser, Esq., J.P.
*E. M. Waraker, Esq., J.P.
*R. M. Collins, Esq., J.P.
Alexander Muir, Esq., J.P.
C. B. Lethem, Esq., C.E.
*John Cameron, Esq., J.P.
Hon. Sir Arthur Morgan, Kt., F.R.G.S., &c.
Hon. C. F. Marks, M.D., M.L.C., &c.
Hon. F. T. Brentnall, M.L.C.
James Stodart, Esq., M.L.A.
J. R. Atkinson, Esq., L.S., J.P.
L. F. Schoenheimer, Esq., J.P.
Ald. John Crase, J.P.
L. C. Horton, Esq., J.P.
J. T. Embley, Esq., L.S.
Rev. L. L. Wirt, B.D.
Capt. W. C. Thomson.
R. H. Mathews, Esq., L.S., J.P., &c.
*T. S. Sword, Esq., J.P.
George Phillips, Esq., C.E.
A. A. Spowers, Esq., J.P., &c.
A. S. Kennedy, Esq.
Alexr. Corrie, Esq., J.P.
Major A. J. Boyd.

* Dead.

List of Members.

(P) Members who have contributed papers which are published in the Society's "Proceedings and Transactions." The numerals indicate the number of such contributions.

(PP) Past President.

A dagger (†) prefixed to a name indicates a member of the Council.

Life members are distinguished thus (*).

Should any error or omission be found in this list, it is requested that notice thereof be given to the Hon. Secretary.

Foundation Members :

P1 Allardyce, His Excellency Sir Wm. L., K.C.M.G., Govt. House, Nassau, Bahamas.

Alton, R., Brisbane.

Armour, R. L., J.P., Brisbane.

P1 Atkinson, J. R., L.S., Ipswich.

Bailey, T. S., Survey Department, Brisbane.

P1 Bartley, N., Brisbane.

Bell, W., Supreme Court, Brisbane.

P1 Bennett, E. J., Survey Department, Brisbane.

Brydon, J. M., J.P., Brisbane.

Coghlan, J., Mount Eagle, Cooyar.

Daniell, E. N., Survey Department, Brisbane.

Davidson, W. M., Deputy Surveyor-General, Brisbane.

Drury, E. R., C.M.G., General Manager Q. N. Bank, Brisbane.

Ferguson, J., J.P., Brisbane.

Foxton, Hon. J. F. G., Brisbane.

Fraser, T., L.S., Brisbane.

Gailey, R., J.P., Brisbane.

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Queensland

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GEOGRAPHICAL FACTORS CONTROLLING THE SETTLEMENT OF TROPICAL AUSTRALIA.

(*With* 32 *Maps.*)

Thomson Gold Medal Thesis.
1917.

By Griffith Taylor, D.Sc., B.E., B.A., F.G.S., F.R.G.S.
Physiographer, Commonwealth Weather Service; Lecturer in Meteorology at the Commonwealth Aviation School; Instructor at the University of Melbourne.

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INTRODUCTION.

Australia, including Tasmania, has an area of 2,974,586 square miles. It constitutes about one quarter of the British Empire, and is nearly twenty-five times as large as the United Kingdom. It is this great size, taken together with the fact of the limited population (4,940,952 in 1914) that gives to the problems of Australian development their unique character.*

* G. H. Knibbs, Commonwealth Year Book, 1908.

Tropical Australia is divided, politically, among the three regions of Queensland, Northern Territory and West Australia in the following proportions ;—

	Area.	In Tropics.	Per Cent.
Queensland	670,500	359,000 sq. miles	53.5
N. Territory	523,620	426,320	81.4
W. Australia	975,920	364,000	37.3
Commonwealth Total ..	2,974,581	1,149,320	

Tropical Australia, therefore, constitutes 38.6 per cent. of the area of the Commonwealth.

Reference to the statistical records shows that the population is distributed somewhat as follows (exclusive of aborigines). (See Fig. 32).

	Total.	In Tropics.	Per Cent.
Queensland	676,707	160,000	24
N. Territory	3,973	3,500	90
W. Australia	323,018	5,000	1.5
Total		168,500	

In each of the three divisions, the population is, therefore, differently distributed. In Queensland, we have a large tropical population, constituting 95 per cent. of all our tropical settlement, and forming an important portion of the whole people of the State.

In Northern Territory, 90 per cent. of its small population is congregated in the warmer regions, and hardly any in the relatively cooler inland areas ; while in West Australia, less than 2 per cent. is found in the enormous tropical areas.

A consideration of the reasons for these differences—which are natural, and in accord with the logical principles governing the spread of population—will be found to give the key to the problem that confronts us.

Questions of tropical settlement have been discussed usually by people who are sadly lacking in methods of comparative science. There is the hardy bushman, living wholly out of doors, with the healthiest occupation in the world. His opinion is valuable only as regards the conditions of pastoral life.

There is the politician pledged to the policy of the exclusion of coloured races, who makes his flying visit in the most favourable time of the year, and "sees no reason why a thriving white population should not fill our tropical areas."

There is the Government official, who is usually engaged in promoting some branch of industry, and is, naturally, not inclined to dwell on the disabilities which handicap it. Some few impartial accounts are to be found but they are swamped beneath the advertising literature, which constitutes the bulk of our tropical bibliography.

Surely the sane way to treat this problem is that followed in all other scientific problems. First the stage of careful description. Secondly, the stage of classification. Thirdly, the stage of co-ordination and comparison. And, lastly, the stage of conclusions or construction.

This is perhaps a counsel of perfection, but the method adopted so far appears to omit entirely the co-ordination, to dispense with most of the description, and to select for judgment only the brighter aspects as determined by a very cursory attempt at classification.

TOPOGRAPHY.

Of all the six continents, Australia has, by far, the lowest average elevation. Antarctica is very largely a plateau over 7,000 feet high. Asia has her great Tibetan Plateau; and all the warmer regions belong almost generally to the Highlands. America has an immense belt of great width running down the western side of the continent; while Africa, south of the Equator, is almost wholly over 3,000 feet The northern portion is certainly somewhat low, and in many ways it is this northern African region which offers the closest parallel to tropical Australia.

Speaking generally, it is advantageous for temperate regions to take the form of lowlands, and for tropical regions to be at considerable altitudes. Our continent, unfortunately, exhibits its chief highlands in the cooler regions—while the tropical portion is almost wholly below 2,000 feet.

Let us glance more particularly at the topography of Northern Australia (see Fig. 1.) There is a belt of lowlands (below 500 feet), which is broadest in the north and almost absent along the east coast. We may compute it roughly as one-quarter million square miles. This lowland belt—as usual—is directly correlated with the past geological history of the continent. The east coast is a region of great subsidence. The steep scarps of the Bellenden-Ker Ranges show where whole territories have sunk below the sea in tertiary times.

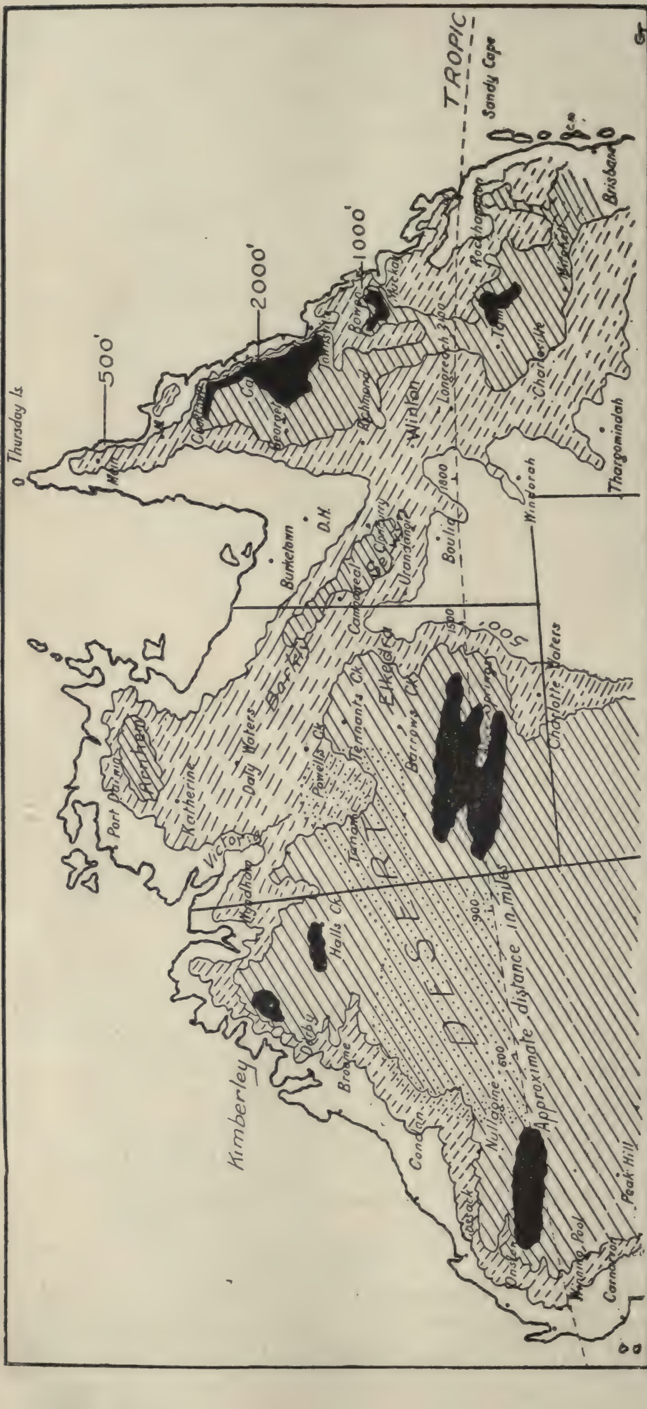


FIG. 1.—Topography of Tropical Australia. Black—over 2,000 feet, Ruled—over 1,000 feet, Broken—over 500 feet. Dotted—desert.

The low-lying shores around the Gulf of Carpentaria indicate a rising coast; while the region to the north-west, though indicating submergence on the whole does not give evidence of such recent changes.

Inland, the tropics can be considered in three divisions. The most important is the West Australian peneplain—which extends almost across Northern Territory to the Diamantina Basin. This exhibits a remarkably level expanse, about 1,500 feet above the sea, which includes an area of some one-third of a million square miles. Some few ancient ranges, which project above the 2,000 feet contour, will be considered more particularly later.

The second division extends approximately from Darwin to Longreach, as an elongated strip, with an average height of 800 feet or so. As in the previous case, two or three more elevated portions—such as Arnhem Land and the Barkly Tableland—merit more particular attention. This division totals one-quarter million square miles.

The third division is the Eastern Highlands, extending from Cooktown to the Bass Straits, but for our purposes, reaching only to the Tropic in the Fitzroy Valley. This belt is about 600 miles long, and comprises (with its intermont areas) about one-quarter of a million square miles.

We may summarise the topographic units as follows:—

Region.	Elevation.	Average.	Approx. Area
1. Coastlands	Below 500 feet	250 feet	250,000 sq. m.
2. W. Peneplain ..	Above 1,000 ,,	1,500 ,,	400,000 ,,
3. Central Uplands	500-1,000 ,,	800 ,,	250,000 ,,
4. East Highlands ..	Above 1,000 ,,	1,500 ,,	250,000 ,,

THE COASTLANDS.—Commencing in the west, a general account of this region will enable us to determine its economic possibilities. The region of scanty summer rains in the extreme south-west of the Australian tropics is crossed by numerous cartographically imposing rivers such as the Ashburton, Fortescue and De Grey. These, however, for a large period of the year, are mere chains of water-holes, and except in the wet season, or after occasional thunder-storms, there is little surface water.

The lowlands (below 500 feet) are somewhat restricted here by the Hamersley Range and similar plateaux to the east. Broad alluvial plains fringe the coast—some 40 or 50 miles wide—but they are practically unoccupied. Only a few small settlements, such as Carnarvon and Onslow, serve to connect the more valuable hinterland

with the coastal traffic. Cossack and Roeburne are more important places—but are also dependent chiefly upon the mining and pastoral interests, situated some distance inland.

FIG. 2.—Topographical Units in Tropical Australia. Coastlands are dotted. Central Uplands are ruled. Western Peneplain and Eastern Highlands are not stippled.

To the north, the coastlands become wider. The rainfall, though confined to summer, is heavier here than further south, so that there are considerable stretches of fairly grassed country behind the Ninety-Mile Beach. As usual, the actual shore is often fringed with mangrove and ti-tree thickets, while barren patches of spinifex and sand form outliers to the great arid waste, which extends eastward to the Macdonnell Ranges.

THE "RIA COAST," from Broome to Wyndham, is characterised by deep branching inlets (rias); which are merely drowned river valleys. The rivers are much more important here—the Fitzroy being the chief stream. The Glenelg, Prince Regent and Drysdale have all cut their way deep into the dissected Kimberley Plateau, so there is practically no coastal lowland in this portion of Western Australia.

Around Wyndham, and along the Ord River, the country is somewhat less rugged; but it is not until the Territory is reached that the 500 feet contour recedes some distance from the sea's margin.

THE VICTORIA RIVER COUNTRY carries large herds of cattle and the river is navigable for small craft for 100 miles; while the next river, the Daly, is the site of one of the few agricultural experiments in the north of Australia. The latter river is navigable for light-draught boats for 60 miles. The lowlands are from 100 to 200 miles wide in the western portion of the Territory, but are much narrower

in the north-east, where the Arnhem Plateau rises to 1,000 feet at no great distance from the sea. This portion of the coast is, however less well known than perhaps any similar hinterland in Australia.

Around the GULF OF CARPENTARIA, the coastlands have their maximum extent, in the region under consideration. Where the Roper River crosses them, they are about 100 miles wide. This fine river is said to be navigable for 90 miles by vessels drawing 14 feet. Obviously, its basin forms a valuable portion of our tropical area. The next large valley—the Macarthur—may one day be traversed by a railway leading to the fine natural harbour among the Pellew Islands.

The north-west coast of Queensland consists largely of low-lying delta country, crossed by numerous rivers and their distributaries. Among the more important are the Nicholson, Gregory, Leichhardt, Flinders and Gilbert. Very good cattle country occurs in the "Downs" just south of the deltas.

Along the western side of the Peninsula, the country is almost unoccupied, save for a few mission stations. Similar low-lying country occurs along the lower courses of the Staaten, Mitchell, Archer and Batavia Rivers. It is worthy of note that the Mitchell rises immediately on the steep scarp overlooking Trinity Bay—implying that the east coast of the Peninsula is of very recent geological formation. This fact is indicated also by the character of the canyon of the Barron, and by the presence of the reefs of the Great Barrier*, which have grown on the sinking eastern moiety of North Queensland.

The EAST QUEENSLAND COAST is eminently free from lowlands. A few river mouths, such as the Burdekin and Pioneer, have limited areas of lowland surrounding them; but the Normanby Valley, behind Cooktown, and the lower Fitzroy, at Rockhampton, have each about 4,000 square miles of lowlands associated with them. The latter lies on the Tropic, and the southern portion should not strictly be included among tropical areas.

THE TROPICAL WEST PENEPLAIN.—This region is well defined on the west by the coastal slope, and on the east by the rapid descent to the inland rivers draining into the north-east of Lake Eyre. The south boundary is the Tropic of Capricorn. On the north, there is an extremely gradual descent from the 1,000 feet contour to the 500 feet contour, as can be seen from Fig. I. I have, however, adopted the 1,000 feet contour as the boundary, premising that there is little difference physiographically between the Barrow Creek region and that slightly lower around Daly Waters.

* Hedley & Taylor—Reefs of Great Barrier. Aus. Assoc. Adv. Sci., 1907.

In West Australia, almost the whole region consists of relatively level-bedded sediments of medium to late paleozoic age. The formations are, in fact, very different from those constituting the temperate portion of the State, and (speaking generally), as a consequence, the mining prospects in the north are much less favourable. There are, however, several "inliers" of older metalliferous formations, such as in the Pilbarra and Hall's Creek areas, where a considerable amount of profitable mining has taken place.

There are three well-defined regions in the Western State. In the north are the Kimberley Highlands, in the south-west the Pilbarra Highlands, and in the centre and south-east the great Sand-ridge or Desert area.

Hardly anywhere in Australia are there any mountain ranges in the true sense of the word. Australia has been free from marked buckling of the earth's crust for many geological ages. Great areas have certainly been uplifted, but rather as bulges and plateaux, than as local corrugations, such as built the Himalayas, Alps, Andes, etc. Hence our "mountains" are rather the scarps of "fault-blocks," and our "ranges" are rather "residuals," left by river erosion. This has a great practical bearing on conditions of settlement. For instance, the Kimberley Ranges are merely the relics of a dissected plateau—in which the rivers have cut deep gorges. (A classic example exists in the famous Blue Mountain area to the west of Sydney). As a result, these upland "ranges" are often well suited for pastoral purposes, and, indeed, much of the range country in the Kimberley district has been leased already.

In this region, as elsewhere, the two factors of soil and climate control settlement. I shall dwell on the importance of physiographic reconnaissance later in the essay; but the Kimberleys offer a good example of the problem.

Brockman, in 1901, explored the more elevated region. He classifies the country according to its geological structure. Thus, three-quarters consists of sandstone tablelands with sandy soils, which are lightly grassed, and are traversed by deep gorges. The other section consists of basalt country, which reaches from Napier Broome Bay south to the Leopold Ranges, and consists of loamy soils with splendid grass. It is also good country to the west of Wyndham.

The Fitzroy River appears to mark off the northern rugged country from the more undulating open plains to the south. Here, also, as we shall see, the rainfall drops off very quickly—and soon the spinifex and sand ridge country is entered.

THE SAND RIDGE OR DESERT REGION.—This has been approximately limited for us by Warburton, Carnegie and other explorers. While most of its terrors have been greatly minimised since a stock route (see Fig. 15) has been surveyed across it from Hall's Creek to Wiluna—yet it still remains the most unhospitable region in the continent. It extends approximately from the head of the De Grey River to the eastern border of the State (see Fig. 1.), and from latitude 19° S. (south of Derby) to the Tropic—but omitting the Sturt's Creek area. Carnegie crossed some 420 miles of sand ridge country on his traverse from Lawler's to Hall's Creek. The ridges were from 30 to 50 feet high, and ran approximately east and west. He describes most of the country as a great undulating desert of gravel, formed largely of pebbles of ferruginous sandstone. In a day's march of some twenty miles, from 60 to 100 ridges would be crossed.

It must not be forgotten, however, that there are possibilities of artesian water in the north-western portion of the sand ridge country. The desert artesian basin reaches from Condon to Derby, and extends inland for, perhaps, 300 miles. The pearling port of Broome is supplied by this water, and a few bores have been sunk in the region around Derby. The bearing of this factor on the pastoral possibilities will be considered later.

THE PILBARRA REGION resembles the Kimberley region, but greater elevations are reached. The most prominient feature, perhaps, is the Hamersley Range, which is a bold scarp along the southern side of the Fortescue River. The highlands rise to Mount Bruce, which is over 4,000 feet high, and (as Fig. I. shows), there is a considerable region of land over 2,000 feet high in the vicinity. The topography is that resulting from the lengthy erosion of an uplifted peneplain. According to Jutson, it is of a more mature facies than in the Kimberley region. Hence the valleys are broader, and the streams have approached nearer to their base level. From an economic point of view, this means that less of the unbroken tableland remains, but that communications along and across the valleys will be easier. Although the chief settlement, so far, has been due to the mining at Marble Bar, Nullagine, etc., yet there is considerable development in the pastoral industry, both as regards cattle and sheep. Only the extreme western and lowland portion of this section is situated in an artesian basin.

In NORTHERN TERRITORY the western peneplain can best be considered under two sub-divisions. These are (*a*) the Tanami Arid Region, and (*b*) the Macdonnell Ranges.

THE TANAMI ARID REGION.—This comprises the upland area south of the Victoria River basin, and extending to the Macdonnell Ranges. The sole settlement is the mining field of Tanami, discovered by Davidson in 1900. He describes the region as a "central desert extending west from longitude 134°, and between latitude 19° and 22° S." An arid lobe projects north-east to Newcastle Waters; while the better class "granite country" sends a lobe into the southern portion of the desert. This arid region includes an area of at least 30,000 square miles. The drainage from the Hanson, Lander, Winnecke etc., seems to collect in a shallow salty depression in the centre. "The pastoral area of value stands at one block of splendidly-grassed country covering 500 square miles," in the vicinity of Tanami.

The country is almost level—a hill of 500 feet being noticeable almost anywhere in the east. Sandy plains, dotted with mulga scrubs and claypans, are characteristic of the region. For 220 miles Davidson met with no permanent water, until the head of Winnecke Creek was reached. No water had flowed down the latter for years but rock-holes containing six months' supply were met with; though there were only two holes in the whole area which Davidson classes as permanent.

The Barrow Creek region, to the east of that last described, belongs economically to the better-class country of the central uplands, although a considerable portion lies somewhat above 1,000 feet. It is more convenient to postpone its description.

THE MACDONNELL RANGES.—This group has more of the character of the typical range than almost any other example in Australia. They consist of a series of parallel ridges running east and west. In the north is the Macdonnell proper, extending some 200 miles, and rising to 4,786 feet in Mount Heughlin. The eastern portion is less linear, and spreads into a knot of highlands surrounding Arltunga. Some miles to the south is the Horn Valley, a unique feature which is bounded for 200 miles by parallel walls. Further south again are the James and Levi Ranges. These ridges are due to the dissection of an ancient series of synclines and anticlines of early Paleozoic age.

The upper waters of the Finke River, instead of flowing along the east-west valleys, cut right across them. Thus a series of extraordinary gorges are produced, which will have a distinct influence on future settlement in this area. These gorges are often only a few yards wide, and contain permanent pools of splendid water. They

are ideal situations for reservoirs, such as the Americans are building throughout the arid Rockies. They are, unfortunately, all south of the Tropic.

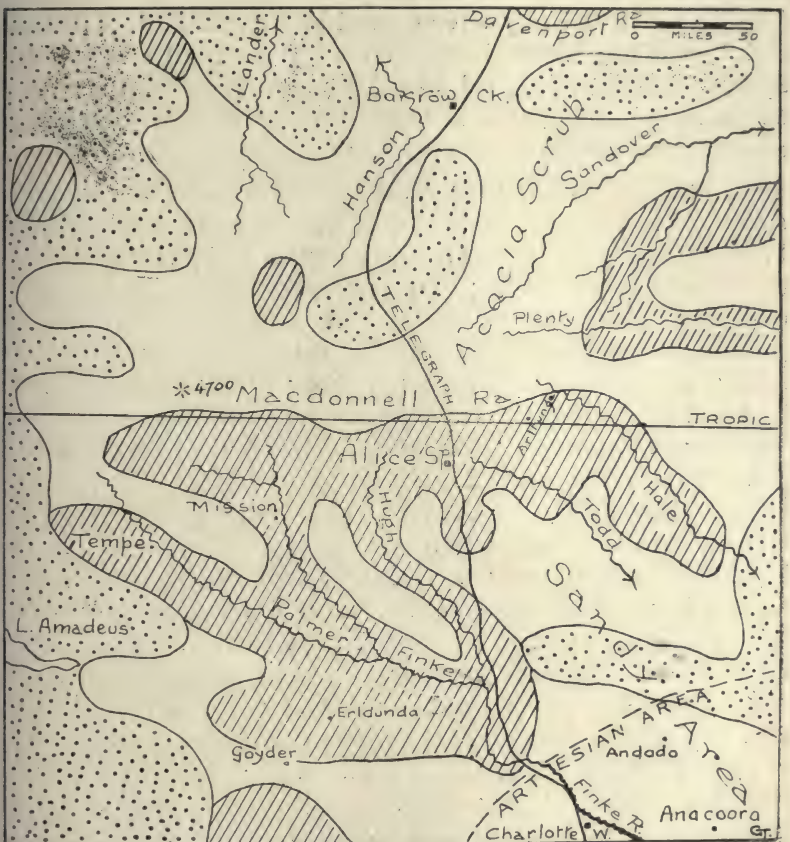


FIG. 3.—Generalised Pastoral Map of Central Australia (based on Day's descriptions for the winter of 1916, which was distinctly wet). Ruled areas mostly well grassed valleys with Mitchell grass and edible shrubs. Blank areas rough or sandy country interspersed with fair grass flats and salt bush, etc. Dotted areas chiefly spinifex and sandy country, feed scarce or absent. Mulga is almost universal. N.B. Permanent water is rare.

Only the northern portion of these highlands belongs to tropical Australia—for the tropic runs north of Alice Springs, and almost through the Arltunga mines. Although the highest land is included, yet the best pastoral country lies south of the tropics, around Alice Springs and Tempe Downs (see Fig. 3.) However, there is plenty of pastoral country of fair quality, which only requires a supply of

permanent water to greatly increase the grazing capacity of this portion of the Territory. The Burt Plain, along the northern flank of the ranges, is described as eminently suitable for sheep, if sufficient wells and dams were constructed.

The mining industry is represented by the gold fields of Arltunga and Winnecke's Depot, lying some 50 miles north-east of Alice Springs, and the mica field near Arltunga. These would probably be paying propositions with adequate communications; but under existing conditions, practically no work is being carried on.

THE CENTRAL UPLANDS.—This section is concerned with very much more promising country than that included in the Western Peneplain. It comprises the northern portion of the Territory and the north-west of Queensland; and as already stated, is of moderate elevation, mostly from 500 to 1,000 feet. It can best be considered in seven sub-divisions:—(*a*) Victoria River Uplands; (*b*) Arnhem Land; (*c*) Central Sub-division; (*d*) Frew River; (*e*) Barkly Tableland and its continuation into Queensland, which we may call (*f*) the Selwyn Highlands. Finally there are (*g*) the Winton Uplands and the Boulia Region. See Fig 2.)

(*a*) VICTORIA RIVER UPLANDS.—Jensen has given a good description of this country, which lies between Katherine and Tanami. It consists of the somewhat broken country to the west of the tableland, which has been eroded by the head waters of the Victoria—though the original level is still indicated by numerous flat-topped hills. A belt of volcanic rocks runs across the country from north to south, and has, undoubtedly, improved the soils of this region. Almost a dozen cattle stations are scattered through this division, where over 200,000 cattle are pastured. The limestones and volcanic rocks near Wave Hill grow abundant Mitchell grass, and this country is better watered and timbered than the Barkly Tableland.

(*b*) ARNHEM LAND.—Very little is known about the detailed topography of this area. It appears to be a dissected plateau of about 1,000 feet elevation, rising to 1,500 feet in places. It consists, according to Jensen, principally of sandstone, probably of carboniferous age. There is a well-marked meridional scarp—almost inaccessible—which bounds the higher plateau for some eighty mile. The surface is largely covered with laterite, and much of the soil is poor. Along the north-eastern side, well-grassed swamp lands fringe the river mouths; and where occasional volcanic rocks occur, as in the south-east, there is splendid grass. This has been stocked in the past along the Wilton River, but is not permanently held. No important mineral deposits have been discovered.

(*c*) CENTRAL SUBDIVISION OF UPLANDS.—These form part of a peneplain of lower elevation than that of Arnhem Land and that around Tanami. (This does not imply that it is of different origin). Speaking generally, the country consists of very ancient altered rocks and gneisses and granites in the north, on the edge of the coast lands, around Pine Creek. These contain valuable minerals, from which over £2,000,000 of gold, tin worth £300,000, and wolfram, copper, silver and lead, to the value of £200,000, have been produced. South of this, Cambrian quartzites and limestones stretch almost uninterruptedly to Newcastle Waters, and east to Camooweal. These contain no important mineral deposits.

Patches of good country are common, especially near the Roper tributaries. The latter rises in permanent springs, and deep reaches of splendid water occur in the neighbourhood of Mataranka, and indeed along the whole course to the mouth On the whole, the country is poor compared with the Victoria Region to the west, or the Barkly Region to the east. From Katherine to Mataranka, there is a moderate supply of permanent water. Thence south to Newcastle Waters (about 180 miles) is served by four wells, to be supplemented by several sub-artesian bores. There are no settlements away from the telegraph line in the southern portions, but about 100 whites and 500 Chinese are engaged in mining, chiefly in the vicinity of Pine Creek. The chief pastoral holdings are all to the east of this division. The sparse population is illustrated by the fact that even along the telegraph line for 300 miles, from Katherine to Newcastle Waters, there are only three men (at the telegraph office at Daly Waters).*

THE FREW RIVER REGION.—This is an ill-defined region lying between the elevated Macdonnell Ranges and the Barkly Tableland. It lies just about 1,800 feet in elevation, and consists of the Davenport and Murchison Ranges, and the basins of such rivers as the Frew, Gosse and Elkedra, which rise therein, together with the Sandover, etc., to the south. The region surrounding the Frew and Elkedra Rivers, with the Murray Downs to the south, is good pastoral country. It deteriorates, however, to the east and south-east.

THE BARKLY TABLELAND.—This is an elongated region extending from Powell's Creek to Camooweal (Q.), and about 150 miles wide. It may be estimated to contain 40,000 square miles. It consists of slightly undulating country, varying from 600 to 1,000 feet above the sea. The rocks are almost wholly Cambrian quartzites, sandstones, limestones, etc. "The quartzites constitutes the so-called

* J. A. Gilruth, 1913. Official Report.

deserts—generally low rises covered with sparse timber. The black soil plains are treeless, and covered with Mitchell grass." Large quantities of sub-artesian water occur in the folded strata, but have not been used to any great extent yet.*

There are a large number of stations on this Tableland, and some 150,000 cattle and 50,000 sheep are grazed thereon. This, by no means, implies a large population. Thus, in the north, Nutwood heads the list with 13 whites, while half-a-dozen are sufficient to control the grazing on some of the largest of these stations. Permanent water is very scarce in a bad season ; Eva Downs Station and Anthony's Lagoon Police Station being temporarily abandoned on such occasions.†

On the head waters of the Georgina, near Queensland, are Avon Downs and Austral Downs ; and some half-dozen more lie in the region to the north, which, in the wet season, drains into the Cresswell and Playford Rivers.

Selwyn Highlands.—This is a convenient name for the extension of the Barkly Tableland towards Central Queensland. The divide between the coastal rivers and those draining inland, gradually becomes higher to the east, so that the railway terminus at Selwyn is 1,200 feet above the sea. These highlands are formed of older Paleozoic formations, Silurian and Cambrian probably, and hence are favourable areas for mining. The Cloncurry field is one of the most important producers of copper in Australia. The region as usual, is of an undulating plateau type. The Georgina and Hamilton Rivers water the southern slopes, and there are many important settlements. The chief are Camooweal, Urandangi and Boulia—which are all on the western plains at the foot of the highlands ; but for convenience may be associated with the adjoining region.

Winton Uplands.—This is one of the most important pastoral regions in Australia. It consists of "downs country" on each side of the divide in North-Central Queensland. None of this region is over 1,000 feet, and no marked natural feature separates the basin of the Flinders from the Thomson and Diamantina to the south. The surface rocks belong almost wholly to the Rolling Downs formation of cretaceous age. Outliers (or mesas) of desert sandstone are abundant, and the opal fields of Kynuna and Opalton are associated with these rocks. Of more importance is the great Artesian Basin—the largest in the world, which is very well developed in the region

* W. G. Woolnough, 1912. Official Report.

† J. A. Gilruth, 1913.

under review. Richmond, Hughenden, Winton and Muttaburra are all important pastoral towns in this area. It is served by two important railways—the Northern to Winton and Cloncurry, and the Central to Longreach.

THE EASTERN HIGHLANDS.—This region is a dissected peneplain of considerable elevation, whose eastern edge has been sharply truncated to form the east coast. The slope is very gradual on the western flank. It is divided into regions by several well-established river-basins, the chief being the Burdekin and Fitzroy.

The most convenient divisions are (*a*) Peninsula Highlands; (*b*) Atherton Plateau; (*c*) Hughenden Highlands; (*d*) Peake and Clarke Ranges. (See Fig. 2.)

(*a*) The backbone of the peninsula consists of a range rising to 2,000 feet, and extending from Shelburne Bay southwards to Palmerville. It lies close to the east coast, except in the south, where the Normanby Valley flanks it. There are a few cattle stations and telegraph stations at Musgrave, Coen, Mein, etc., while mining occurs, to a small extent, near Coen and Laura.

(*b*) ATHERTON PLATEAU.—This is the most promising tropical area in Australia. It extends from Cairns to Townsville, and inland to Mount Surprise. This triangular area, all over 2,000 feet high, covers about 12,000 square miles. Large areas of granite, associated with mineral deposits, occur on the plateau; so that the district is favoured by good climate, favourable rainfall, good soil, and valuable mines. Chillagoe, Stannary Hills, Mungana, and Wolfram Camp, are all mining towns.

The country is opened up by the Cairns to Forsayth railway. It is watered by the head waters of the Mitchell River on the west, and by the short, but steep, valleys of the Barron, Mulgrave, Herbert, etc., which have cut gorges in the eastern scarp. This region seems well suited for future hydro-electric development.

The special features of the forest flora on this scarp will be described in a later paragraph.

On the west, the Atherton Plateau merges gradually into the lowlands of the western coastlands. Large numbers of cattle, including many dairy herds, are grazed on the plateau and its western slopes.

HUGHENDEN HIGHLANDS.—This is a somewhat indefinite name for the country lying between 1,000 and 2,000 feet on both sides of the northern railway. It is about 100 miles wide and 200 miles long, and constitutes the divide between the Burdekin, Thomson and Flinders Rivers. On the northern margin, are the Croydon and Etheridge gold fields; and in the east, are the Charters Towers

and Ravenswood gold fields ; but as a whole, the country is devoted to the pastoral industry. A group of ancient volcanoes north of Hughenden, has given rise to a fertile soil.

To the south of Hughenden the highlands are largely built of the barren desert sandstone. The rains which supply the artesian basin (according to one theory) are supposed to enter the porous beds along the western slopes of this divide. There is no well-defined range, as may be judged by the presence of two large lakes (Buchanan and Galilee), perched right on the divide to the south-east of Hughenden. Einasleigh, Charleston, Hughenden, Pentland, Charters Towers, are some of the chief towns, which are served by the Chillagoe or Northern railway lines.

Peak and Clark Ranges.—This somewhat arbitrary name includes the elevated region separating the Burdekin from the Fitzroy basins. The highest land is near the coast behind Mackay. Here the Clarke and Leichhardt Ranges build a crescentic ring of highlands over 2,000 feet high around the Bowen River. To the south-west, this elevated " crescent " connects with the main divide, by the elevated region of the Denham, Peak and Drummond Ranges—which do not, however, rise to 2,000 feet. This range is quite narrow just north of Clermont, and contains a large number of extinct volcanic centres, whose lavas have greatly enriched the soils of the Mackenzie and neighbouring valleys. The country is fairly rich in minerals, such as gold and coal, near Clermont, and the gems of Anakie ; but the pastoral and farming interests are more important. It is served by the Central and Clermont railways, while a short line also runs inland from Mackay. The country, on the whole, is somewhat more rugged than those recently considered ; and large settlements are rare. Clermont, Emerald and Bogantungan are three of the chief centres.

THE CLIMATIC FACTOR.

The Tropical Region.—It is important, early in our research, to decide what is meant by the phrase "Tropical Australia." The following quotation gives a patriotic if biassed opinion :—" Latitude for latitude, the Southern Hemisphere is, on the average, much colder than the Northern. The real 'heat equator' is not on the actual line, but is 10° further north. [Hence] only a very small portion of Northern Australia would fall within the Torrid Zone."*

* The Australian People, 1914.

The truth is that, except for a portion of the Sahara, the Australian tropics are hotter than any other region of the world. The north-west, especially, has an unenviable pre-eminence. The only parallel is the Madras coast in India, and this is slightly cooler.

Most world-temperature maps quite ignore the effect of elevation in drawing the isotherms. [This is presumably due to the general lack of contour-data, so that it is thought best to reduce all temperatures to sea level.] As a result, a cool mountain climate, like that of Mexico or Abyssinia, is grouped with those of the Congo or Northern Australia.

Meteorological stations in the tropics are not common yet—but Hann's "Klimatologie" gives many hundreds of actual average tropical temperatures. I have plotted all those localities having annual temperatures in the neighbourhood of 80° F. on the map in Fig 4.

The heat equator is the line joining localities (in each longitude) which experience the highest mean annual temperature. Thus, near the longitude of Greenwich, the heat equator passes through Timbuktu. Further east, it runs through Massowah and Aden, thence across to Madras. So far it lies wholly in the Northern Hemisphere.

As we approach the Australian region, the heat equator swings south across the "line" to pass through Wyndham and Darwin, and thence runs north-east to the Gilbert Islands in the Pacific

In America, the heat equator seems to run along the north coast of South America to Pernambuco, so that here also it passes south of the true equator for a short distance.

It is obvious that the heat equator is controlled by the great land masses. As these are smaller in the Southern Hemisphere—the latter, as a whole, is cooler; but the southern continents themselves are not necessarily uniformly benefited.

A reference to Fig. 4 shows us that four regions (of which records are available) have average annual temperatures exceeding 82° F. These are:—

Place.	Region.	Av. Temp.	Av. Rainfall.
Massowah . .	Red Sea	86° F.	10 inches
Timbuktu . .	W. Sahara	84° F.	under 10 inches
Wyndham	N.W. Australia	84.6° F.	27 inches
Tinnevelly . .	S.E. India	84.3° F.	50 inches

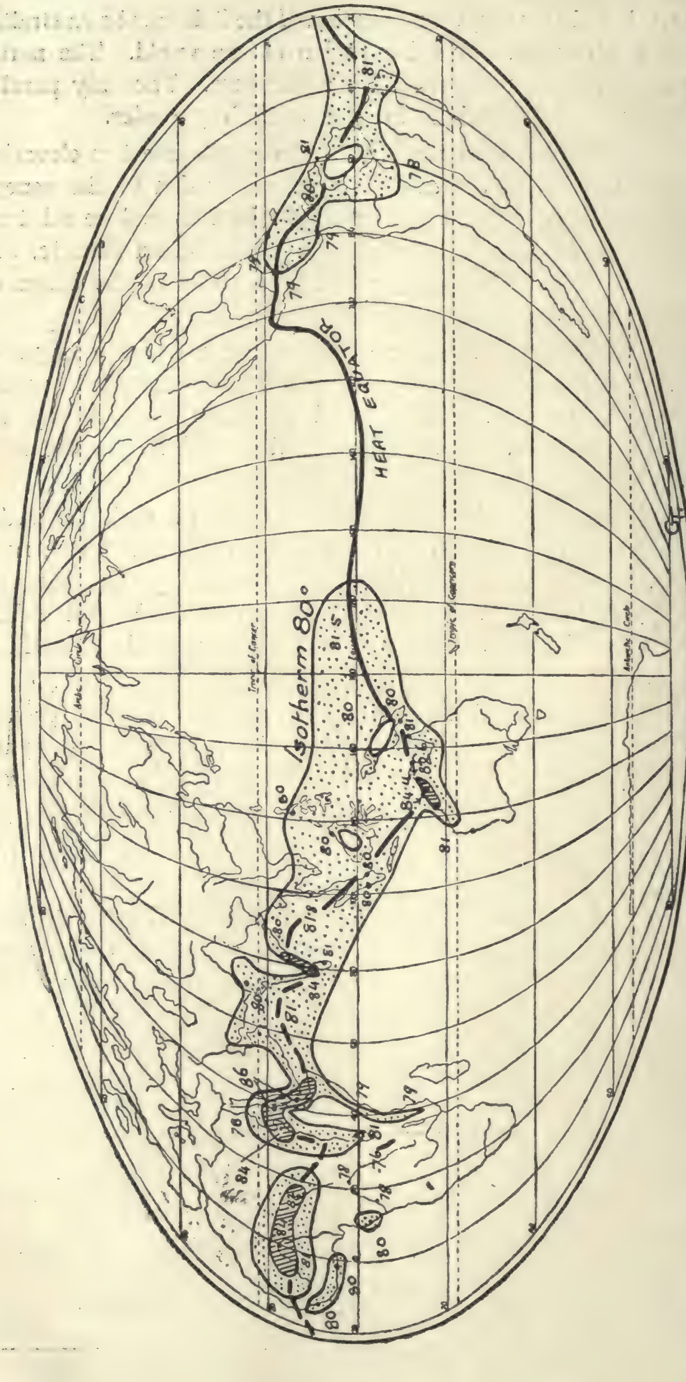


FIG. 4.—The Four Hottest Regions—Timbuktu, Massowah, Tinnevelli and Wyndham. Annual Isotherm 80° F. and Heat Equator also shown. Regions with temperature over 82° F. are ruled. (Data from Hann's *Meteorologie*.)

The two African localities are so dry that the discomfort is greatly decreased, even with the fierce heat. The Indian and Australian localities both experience heavy summer rains, and are, consequently, very muggy during the wet season.

It will be granted that Northern Australia does not benefit in climate from its position in the Southern Hemisphere. However, I have drawn out another set of graphs to illustrate its position with respect to the rest of the world.

In Fig. 5 I have plotted the average figures for various latitudes, as given by Spitaler, from Hann's *Meteorologe.* They show that the Northern Hemisphere (*a* in graph) is about 4° C. (or 7° F.) warmer than the Southern (*b*) round about latitude 20°. The difference decreases to 0° at the equator, and at latitude 45°.

In addition, I have added similar curves relating to longitude 135°, which passes through Australia, Formosa, Japan, etc. These figures are based on Commonwealth data, and on Bartholomew's temperature charts.

We see that Australia, north of latitude 20° S., is hotter than the area to the north, *is hotter than the average Northern Hemisphere,* and hotter than the average Southern Hemisphere for the same latitudes.

On the other hand, the rest of Australia (south of 20° S.), is cooler than the average for the same northern latitudes, but is hotter than regions to the north (along longitude 135° E.), and hotter than the average for southern temperate regions.

These two figures (4 and 5), therefore, show that we shall not be treating Australia unfairly, if we call that portion of Australia north of the Tropic of Capricorn, Tropical Australia. They effectually disprove the quotation with which this section was commenced

TEMPERATURE.—The mean annual temperature for Northern Australia are given in Fig. 6. The isotherm for 80° F. exhibits some peculiarities which deserve notice. The hottest region is not in the extreme north at Thursday Island, but in the north-west at Wyndham. In the west, the 80° isotherm bulges far to the south in the Pilbarra hinterland, just reaching the tropic (23½ S;) This oblique direction of the hot belt is undoubtedly due to the prevalent south-east tradewinds. On the east coast, these winds tend to cool the land, as they come from the cooler ocean ; but on the west side of the continent they are hot winds from the interior during a large part of the year, and so raise the average temperature in the west. Hence, from the point of view of temperature, settlement is favoured in the east, and hindered in the west.

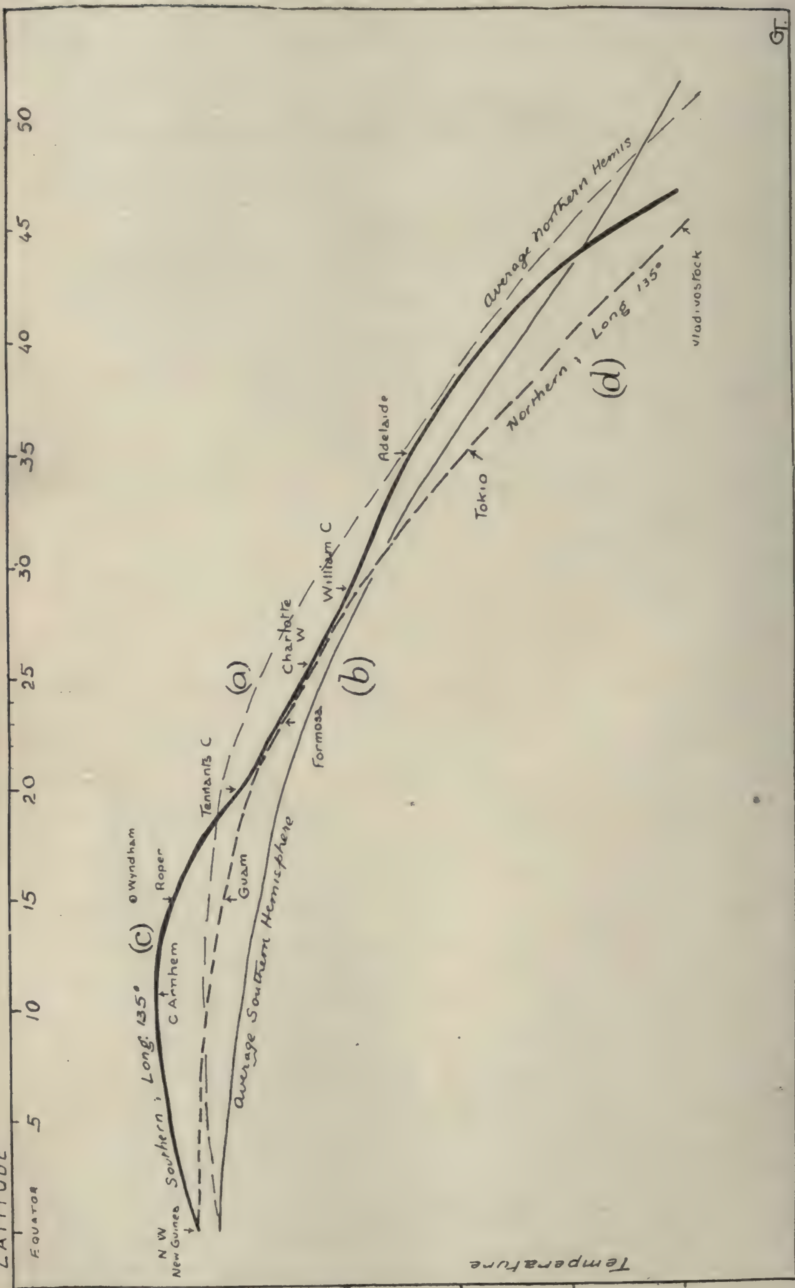


FIG. 5.—Mean Temperatures along Longitude 135° E. (through Australia, etc.) in Southern Hemisphere (thick line c) as compared with those in the Northern Hemisphere (d); also with average temperatures for the two hemispheres (a and b). (Data partly from Hann).

In the cooler months (May, June, July and August), no portion of tropical Australia (except the Derby-Darwin coast) has a mean monthly temperature exceeding 80° F. It is unnecessary to emphasise the fact that in the greater part of the tropics—everywhere except the coastal fringe—the winter months have a delightful climate. But this applies only to the heat conditions, as we shall see the low winter rainfall militates against economic development.

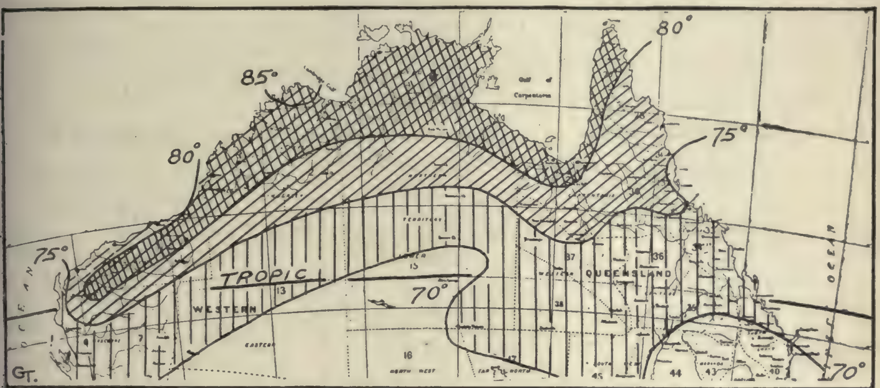


FIG. 6.—Average Annual Temperature in Tropical Australia (after H. A. Hunt.)

In the hotter months (November-March) the whole of the tropics (except the coast south of Cairns) has an average monthly temperature exceeding 80° F. This is an undoubted disability, especially since these months also constitute the wet season. The discussion of the effect of this high temperature on the health and comfort of the population can better be treated after the rainfall and humidity data have been given.

I may emphasise the fact that "comfort," as a factor of settlement, appears to have been largely ignored up to the present. A very high degree of health may be maintained with constant care and moderation, under circumstances which cannot be termed comfortable. In a huge area like Australia, with much of the temperate zone only sparsely settled, it is obvious that prospective settlers will quite reasonably require something beyond conditions of bare *health*. No problem in Australia deserves greater consideration than that dealing with the conditions of comfortable life in our tropics.

TEMPERATURE AND ELEVATION.—As we have now considered the distribution of highlands and isotherms in tropical Australia, we may briefly discuss how much this region is benefited in climate as the result of elevation. One writer asserts, "There exist north

of the tropics considerable areas of sufficient elevation to counteract, to a large extent, the climatic conditions usually found in such latitudes."

On an average, the temperature is reduced 1° F. by an ascent of 300 feet. It will be admitted that an amelioration of 7° F. is necessary to "counteract the climatic condition." This involves an elevation of about 2,000 feet—and all above this level we may provisionally class with Tropical Plateaux.

I have classified these regions in Australia (see Fig. 1.) and their total area is, unfortunately, very small :—

Locality.	State.	Approx. : Area over 2,000 feet.
Atherton Plateau	Queensland	12,000 sq. miles
Clarke Range Area	,,	2,000 ,,
Northern Macdonnells ..	N.T.	14,000 ,,
Kimberley Region	W.A.	8,000 ,,
Pilbarra South	W.A.	10, 00 ,,
Total		46,000 ,,

This area of 46,000 square miles is only 4 per cent. of the total area of tropical Australia, and is in fact practically negligible.

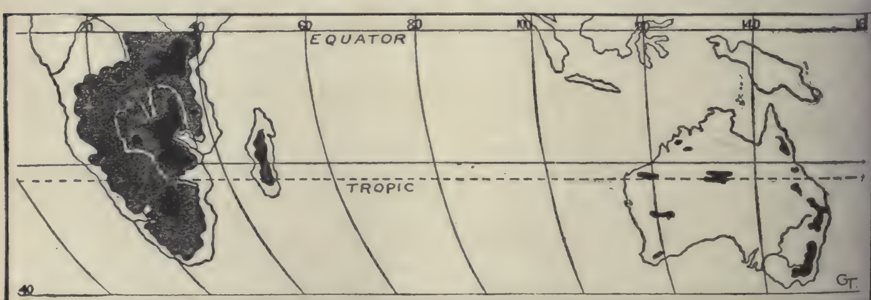


FIG. 7.—Regions above 2,000 feet in Southern Africa and in Australia. The difference in climate between Northern Australia and Rhodesia (area shown by white line), as the result of elevation, is very marked, though they are in the same latitude.

How much more fortunate are other tropical regions is shown at a glance by Fig. 7. Here the corresponding portion in Southern Africa is charted. For instance, in Rhodesia, there are some 400,000 square miles of tropical country, all above 2,000 feet elevation; and with the climate of a correspondingly more comfortable character.

RAINFALL IN THE TROPICS.—While there is little doubt that rainfall is the element which exercises the chief control on Australian industries —and, therefore, on settlement—yet it is very important that wrong conclusions should not be drawn from rainfall maps.

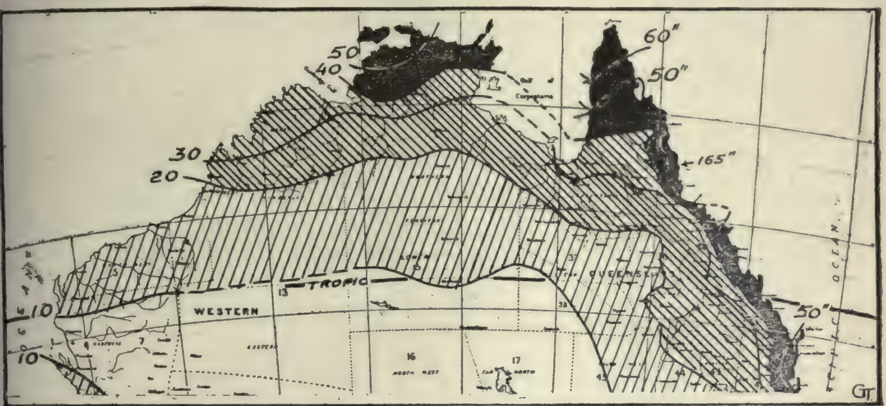


FIG. 8.—Average Annual Rainfall (in inches) in Australia (after H. A. Hunt).

In Fig. 8, the average annual rainfall for the tropics is charted —the region of *heavy* rainfall being shown by the black areas. These extend along the north and east coasts, all of which receive over 40 inches per annum. The region of *good* rainfall (20-40) is shown by close rulings, and has a similar arrangement. The tropic almost coincides with the 10-inch isohyet in the western and central areas, and no portion of tropical Australia receives less than 10 inches in normal years.

From a casual glance at the map, there would appear to be little to choose between the northern and eastern portion of the tropics as regards the element. No greater error could be made. Whether from the point of view of grazing, agriculture, or of health and comfort, there is a strong distinction to be made between the rains of these two regions.

Both belong to the summer rain belt ; but whereas the northern precipitation is confined wholly to the summer months (and in fact for the greater part of this area to the *four* hotter months), the eastern rain is much more uniform. In addition to the period December-March, there is also considerable rainfall in November, April, May and June. This is due to the prevalent south-easters, and to the frequent occurrence of tropical Lows passing down the Queensland coast.

It is easy to show the variation in uniformity on a map, and such a representation is given in Fig. 9.

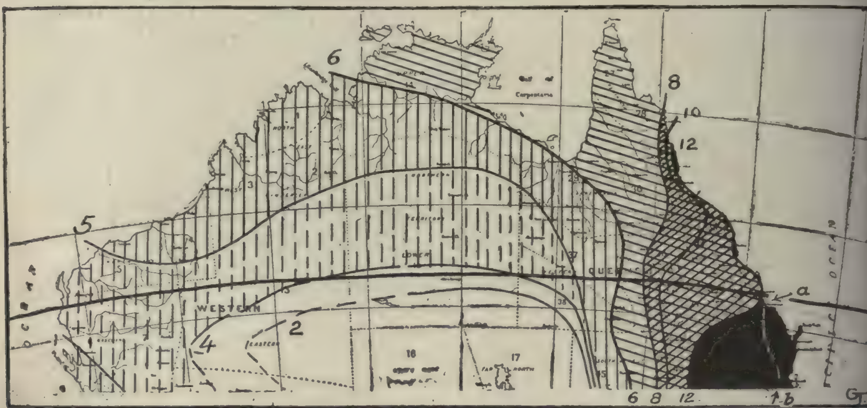


FIG. 9.—Rainfall Uniformity Chart. The figures represent months receiving more than one inch of rainfall.

In Fig. 9, I have plotted the *number of months* receiving over one inch of rainfall per month. A supply of less than this amount is negligible in tropical regions—as may be seenfro m a consideration of the evaporation figures :—

RAINFALL AND EVAPORATION DATA IN INCHES (H. A HUNT).

	JANUARY.		JULY.		ANNUAL.	
	Evap.	Rain.	Evap.	Rain.	Evap.	Rain.
Alice Springs, N.T. ..	12.7	1.7	3.7	0.5	97.1	10.8
Boulia, Q.	15.7	2.1	5.4	0.3	124.5	11.1
Marble Bar, W.A. ..	15.1	2.4	4.4	0.8	115.3	18.5
Thursday Is., Q. ..	—	19.1	—	0.3	77.0*	69.3

*Estimated.

Only along the actual coastline in the north and east does the rainfall compensate for the evaporation. In the interior, the rainfall is just about one-tenth of the evaporation, and there is no need too dwell on the effect of this enormous withdrawal cf moisture upon the resources of the tropics. I shall dwell a little on the effect of this lengthy dry season on the vegetation in a later section; but here, it may be remarked that the well-watered region of our tropics is confined to Eastern Queensland. The rest of the tropics has six,

seven or eight months of drought every year; but this evil feature is compensated to some extent by the presence of an indigenous flora which flourishes through long adjustment to environment.

There is one other aspect of rainfall that is of considerable interest. It is well known that in some regions of Australia, the rainfall is much more reliable than in others—quite irrespective of the amounts. Thus, the 20 inches that the wheat farmer can expect to receive *with some certainty* in the Katanning district of W.A., is much more valuable than the 20 inches which *may* fall in Wiluna in the course of a few days.

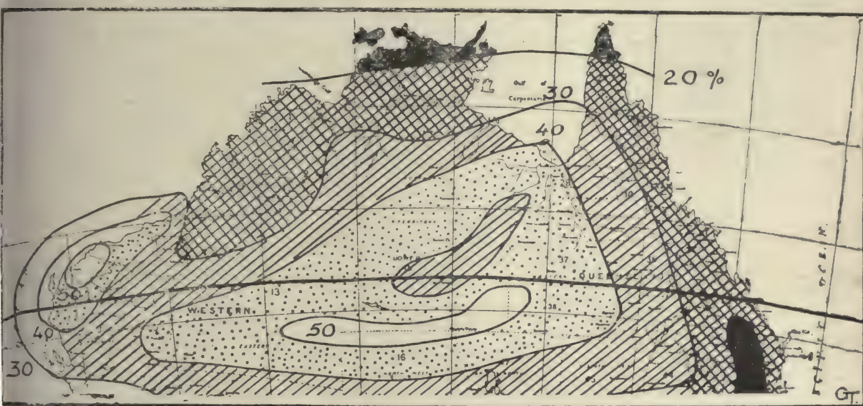


FIG. 10.—Rain Reliability Chart. The figures represent the percentage variations (from the normal annual rainfall) which may reasonably be expected. (Based on data 1891-1910). The black areas are most reliable, and the white and dotted areas the least reliable.

To obtain the reliability chart given in Fig. 10, the following procedure was followed:—

A table of annual rainfalls for 20 years (1891-1910) was consulted. At each of the localities listed, the departures from the *normal* rainfall were obtained. These departures (ignoring sign) were then averaged, and the result expressed as a percentage of the total rainfall. Thus (taking a striking example), the average rainfall at Onslow is about $8\frac{1}{2}$ inches. But it has varied from 1 inch in 1896 to 27 inches in 1900. The averages of all such departures is 5 inches, and this is inserted on the map as 60% (of $8\frac{1}{2}$ inches).

The reliability map shows that Darwin and Thursday Island vary less than 20 per cent. from their normal amount, and that the variation increases inland. Kimberley comes out rather well, probably owing to the prevalence of tropical low pressure storms in the vicinity. But the Pilbarra region is highly erratic; and the rainfall of the Barkly Tableland is not so reliable as might be expected. The Macdonnell

and Frew River regions are slightly better than the surrounding districts. This map seems to me to be of considerable importance in connection with all suggestions of crop-growing in our tropics. I have seen it asserted that the Barkly region, and even the Macdonnells will grow wheat without irrigation. To my mind, even if the rainfall were suitable in *average* amount and season, this map shows that it is too *erratic* to justify agriculture in those regions.

HUMIDITY.—This factor controls the health and comfort of settlers in the tropics, quite as much as the temperature. Speaking generally, regions of high humidity are unfavourable for white settlement. Professor Huntington, of Yale, has given much consideration to the problem and his map* of human energy (based largely on humidity) gives tropical Australia a very poor place in the "world economy." I think, however, that detailed investigation justifies us in somewhat modifying his conclusions as regards Australia.

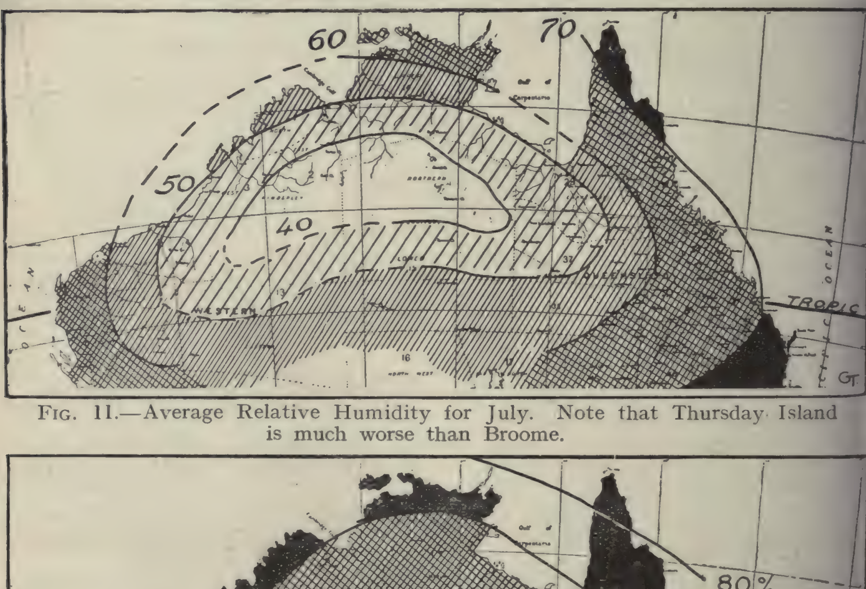


FIG. 11.—Average Relative Humidity for July. Note that Thursday Island is much worse than Broome.

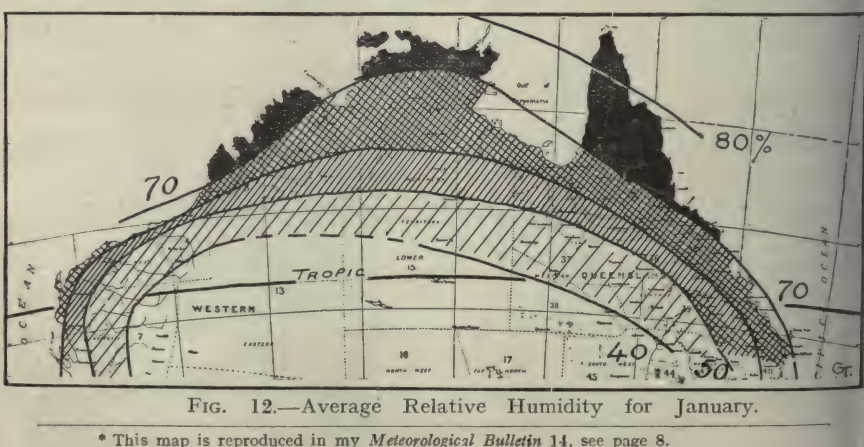


FIG. 12.—Average Relative Humidity for January.

* This map is reproduced in my *Meteorological Bulletin* 14, see page 8.

I give two charts (Figs. 11 and 12) showing the humidity in the hottest and coldest months. In July, the only region with high humidity is Cape York Peninsula, while the Darwin region and Townsville coast have moderately high humidities. In January, conditions are, of course, much worse. All the coastal regions, and a considerable belt inland, exceed an average of 60 per cent. Only in the Pilbarra region is there a hinterland with a moderate humidity in summer. (The general problem of health and comfort is considered in the *Comparative* section.)

It will be seen that the elements rainfall and temperature operate in different directions as regards products and as regards comfort respectively. High rainfall and high temperature mean, usually, a more fertile land with greater resources, and in this respect the eastern tropics have the advantage. But low rainfall and low temperature mean low humidities, and in this respect the western tropics are, on the whole, more comfortable during the summer months at any rate.

An interesting graph, illustrating certain characteristics of the climate of tropical Australia is given in Fig. 13.

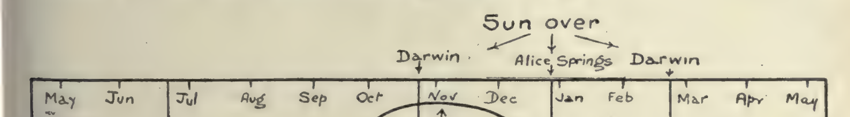


FIG. 13.—Relation of the march of the sun to the change in Temperature, Humidity and Rainfall at Darwin; showing the cooling at midsummer.

Here the monthly variation in temperature, rainfall and humidity are correlated with the sun's declination. The sun is on the Tropic of Cancer late in June (at the solstice), and we see that the temperature at Darwin is then lowest, or about 77° F. There is no rain at all, and the humidity is about 60 per cent. During the next six months, the sun moves southwards, reaching the Tropic of Capricorn at the end of December, when it is overhead at Alice Springs. *En route* it has passed over Darwin at the end of October, and in consequence of a slight "lag," November is the hottest month at that place. While

the sun is heating Alice Springs to the south, the temperature at Darwin has fallen several degrees; so that we arrive at the paradox of a relatively *cool* midsummer. The sun's northern path brings him overhead at Darwin at the end of February, with a corresponding slight heat maximum in March—after which the temperature falls off rapidly.

The rainfall is seen to be at a maximum in January; but the air being more saturated in the later heat maximum, brings the humidity maximum later than the rain maximum (see Fig. 13).

Here, then, we have one reason for the well-known fact that the middle of the "wet" is preferable to the beginning or end of that season. The former has a higher temperature, and the latter a higher humidity.

VEGETATION OF TROPICAL AUSTRALIA.

Undoubtedly, the evidence of a country's possibilities for settlement, which is most readily available, is that furnished by the natural vegetation. It acts as an index to the soils, and to the rainfall and temperature; and on these the great primary industries of agriculture and pasturage are founded. If only two maps were to be available for an economic forecast, then the geographer would prefer the *vegetation* map for the above reasons, and the *geological* map which, in a similar fashion, furnishes the key to the topographic and mineral aspects of the problem.

No error is more common on the part of geographers than to indicate the northern quarter of Australia as covered with a tropical forest. They have been misled by the heavy annual rainfall, and do not realise what I have previously pointed out, that there are six months of drought in each year in the northern tropics. This does not prevent the growth of fairly large trees, but it does account for the absence of true tropical forest filled with lianas and undergrowth, which latter are practically confined to the eastern coast of Queensland.

The broader features of the native vegetation may be classed as follows (see Fig. 14):—(*a*) Desert country; (*b*) Mulga country; (*c*) Savannas or prairies; (*d*) Brigalow country; (*e*) Savanna woodlands; (*f*) Eucalypt forests; (*g*) Tropical rain forests.

The most comprehensive account of the vegetation, as a whole, is that given by Diels, and I have based my classes on those used by him.

FIG. 14.—Main features of the Vegetation of Tropical Australia. Timber Forests are black ; a, b, c and part of f are Tropical Rain Forests ; d, e, f and g are valuable Eucalypt Forests. N.B.—The provinces merge into each other. (Based in part on Diels and Jolly).

(*a*) SAND RIDGE OR DESERT COUNTRY.—This includes the interior areas of the tropical portion of West Australia, and also a considerable portion in the south-west and south-east of the Territory. They are covered by huge ridges of sand, which mostly have an east-west direction, and have been piled by the dominant south-east winds. Carnegie describes them as alternating with small sandy flats, which contain thickets of spinifex and clumps of mulga. Other trees, such as quandong and native poplar, grow sparsely in the hollows. The chief economic plant is the fleshy "parakeelia" (*Portulaca*), which often grows within the spinifex thickets. In the north the vegetation becomes more abundant, and comprises *Grevillea*, *Hakea*, *Melaleuca* and *Casuarina*. Where a creek bed preserves some underground water, fine specimens of the ubiquitous gum (*E. rostrata*) may be met with.

Often the western and northern sides of the ridges are protected from the sand drift, and here small belts of fair country may occur. Saltbush and coarse grass are not rare in such situations. The most promising feature of this region is the presence of sub-artesian water. There is rarely any difficulty in obtaining a supply of drinking water, if sufficient time is available to sink from 20 to 30 feet or so.

In the eastern desert area—a smaller region lying north of Lake Eyre—there is little doubt that there is a better chance of putting it to permanent use. This is due to its southern portion forming part of the great artesian basin. But until this basin is tapped in a sufficient number of places, there is no possibility of its carrying stock in any numbers. From Day's and Barclay's descriptions, the

vegetation is of the same type as quoted above, spinifex and parakeelia being characteristic, but saltbush and cottonbush are not uncommon. (See Fig. 3.)

Only a very small portion of this latter sandy arid tract comes into our survey of the tropics, and, unfortunately, this portion lies outside the artesian basin. However, there is no doubt that well-water can be obtained at shallow depths. Day describes the region along the Sandover River (see Fig. 3) as "undulating sandy country, with moderately dense scrub of dwarf mallee, wattles, etc., with spinifex and patches of mulga; well grassed along creeks."

Tongues of better country penetrate this sandy area along the Plenty River and Hale River. Here are "broad alluvial plains, splendidly grassed, and carrying mulga, ironwood and smaller acacias." To the east there are sandhills up to 30 feet high (running north-west to south-east), which carry edible spinifex. On the flats between are clay areas with mulga scrub and some herbage.

(*b*) MULGA COUNTRY.—It is impossible to separate what may be termed mulga country from the sand ridge or desert country for mulga is the chief tree in the latter also. But in certain regions in the arid country, the mulga is much more abundant than usual. Diels shows two such belts—one covering the arid coast and hinterlands to the south-east of Shark's Bay (which is outside the tropical belt), and another extending from the Macdonnell Ranges to Port Augusta, The northern portion of this latter division comes into our field.

The whole region to the east of the telegraph line, and south of the Davenport Ranges, is classed by Day as "acacia scrub country." This dense growth of scrub consists of wattle (*Acacia sp.*) on the higher hills and on the larger sandy plains; gidyea (*Acacia cambagei*) on the slopes of the ranges, and a portion of the loamy plains in the south; and mulga (*Acacia aneura*) on the greater portion of the sandy plain country.

On the Macdonnells, the principal peaks rise 2,000 feet above the plains to the south. They are bare of foliage, but gums and spinifex grow on the lower slopes; while the plains between the ranges are covered with saltbush and native grasses, alternating with belts of mulga.

SAVANNAS OR PRAIRIES.—This is a very extensive belt, extending from North West Cape eastwards, through the hinterlands in the whole of the tropics. It merges into the sand and mulga country on the inner (drier) side, and into the "savanna woods" on the outer (wetter) side. Moreover, it is at times characterised by wide-

spread areas of small trees belonging to the eucalyptus and acacias, such as the mallee, gidyea, mulga and brigalow. But the general feature of the whole is the open grassy plain.

In the west, for instance along the Fitzroy River, very few big trees are to be seen. Every now and again, however, the country opens into vast plains covered with rich grass, with abundance of bird life and native game.*

In the upper Victoria basin, the vegetation depends very largely (as elsewhere) on geology. "The limestone and volcanic soils alike are excellently grassed with Mitchell and other valuable fodder grasses. The country is almost as good for stock-breeding as the Barkly Tablelands, and has the advantage of being better watered, more diversified with hills and valleys, and better timbered. There is, however, a greater proportion of "desert country" (gum spinifex) than on the Tablelands stations.†

In common with most hot countries, there is a widespread deposit, of laterite and similar surface formations. These are not usually well grassed, nor is the sandstone country, which is, unfortunately, very common in the Territory. The limestone country, from Katherine to Wave Hill, also carries numerous trees, such as bauhenia, mimosa, red gum, bloodwood, hakea, wattle, and prickly acacia,

The central region, between Katherine and Newcastle Waters. is of similar nature, but of less value. Cambrian and later sandstones and quartzites constitute the main formation, and these carry only poor spinifex grass and hedgewood, and stunted gums. The limestones, however, carry Mitchell and Flinders grass, blue bush, and small trees like bauhenia, coolibah and mimosa.

The Barkly Tableland extends approximately from longitude 134° (near Powell's Creek) to Camooweal, and but for the cost of boring for water, would be one of the most valuable regions in Australia. It consists of a "large plain intersected by small irregular areas of quartzite debris. The rich black soil carries no timber, but is well grassed with Mitchell grass, and occasionally with patches of pea-bush and blue-bush." Unfortunately, permanent waters occur only at wide intervals of about 40 miles. However, water can generally be obtained within 300 feet, and bores are gradually being put down.‡

In Central and Western Queensland great areas are covered with Mitchell, Flinders and blue grasses. Among the perennial Mitchell grasses grow plenty of annuals of fodder value. In the

* A. O. Neville, 1916, in the "West Australian."

† H. I. Jensen, 1915. Official Report.

‡ J. A. Gilruth, 1912. Official Report.

eastern part are patches of "Boree" (acacia), but further west there are miles and miles of open plains, and only near the watercourses are there scattered gums, acacias and melaleuca. These give the best possible grazing land, but offer no possibilities for *close* agricultural settlement.*

Brigalow Country.—This type of vegetation is met with throughout the savannah region, but is best developed along the western slopes of the Queensland highlands. It consists of wattle scrub composed of several species, the commonest being brigalow (*A. harpophylla*). Other widespread scrubs are boree and gidyea. The former (*Acacia sp.*) prefers good soil, and is often found on the Rolling Downs, whereas gidyea (*A. cambagei*) grows on the ranges in rocky soil. Lancewood scrubs occur on rough desert sandstone country between Jericho and Alpha. This acacia grows high, with long straight stems, and forms a true forest.†

Savanna Woodlands.—This type forms a zone clothing the wetter areas on the edges of the tablelands. The rainfall exceeds 25 inches per year; and the belt stretches from Broome right round the north coast, to the tropic (and, of course, further south also). Acacias have played the chief part in preceding classes, but in this belt eucalypts are dominant. Undergrowth is practically absent, but grass is universal; and as before, there is no sharp line of division between this "park land" type and the prairies considered earlier.

In the Kimberley region, red gums, white gums, and ironbark of large size are fairly common; while pines, such as Callitris and Araucaria, also occur. Melaleuca, quondong, and less common trees, such as baobab, pandanus and kapok remind one that one is in the tropics. For the most part, these trees are isolated, and no true forests of timber, such as we have in the east and south, occur.

Of the Northern Territory, Atlee Hunt writes:—"Although the greater part of the Territory is within the tropics, the vegetation generally is that common to most parts of Australia; hardly any jungle exists, only a patch here and there. The same, or very similar, trees to those found throughout Australia form the vegetation."

The coastal region of the Territory, near Darwin, consists of open eucalypt forest, dotted with pandanus, ti-tree, pine and other non-eucalypts. White gum (*E. terminalis*), bloodwood (*E. corymbosa*), coolibah (*E. microtheca*), woolly butt (*E. miniata*) are some of the commoner gums.

* K. Domin, 1910. Royal Soc. Queensland (p. 69.)

† K. Domin, 1910. *op. cit.*

In Arnhem Land, much the same vegetation occurs. Sandy areas are covered with spinifex, grassy plains contain box, woolly butt, ironwood, paper-bark (melaleuca) and cypress pine (*Callitris*).

All round the Gulf, the country is low, and, on the whole, poor pastoral country. The vegetation consists of coarse grasses and stunted gums, with much pandanus and ti-tree. When the coast is left, and the elevation is greater, there is a striking improvement, and many stations have been located to the south on the Gregory, Leichhardt, Flinders, and Gilbert. Floods have proved a considerable drawback to the regions around Normanton and Burketown. With the exception of Borraloola, and a few mission stations, there is hardly a settlement along the western and eastern sides of the Gulf of Carpentaria.

North of Croydon, the country consists largely of a level "sandy waste of ti-tree flats, covered with innumerable pinnacles made by white ants."* To the south-west of Croydon, a belt of poor timber (such as inferior bloodwood and messmate) separates the coastlands from the inland grassy plains.

Along the east coast of Queensland the rainfall is much more regular—as described previously—and here the forests are proportionately more luxuriant. But the greater portion is still of the open "parkland" type of the north, with a close undergrowth of grasses. As usual, they consist almost wholly of eucalypts, such as ironbark, coolibah, bloodwood, Moreton Bay ash, stringy bark, etc.

EUCALYPTUS FORESTS.—Hardwood forests of special economic value for sawn timber are confined almost wholly to the temperate portions of Australia. In the tropics, they have been exploited only in Eastern Queensland. I owe to the Director of Forests the following summary:—"The eastern third of Queensland carries eucalypts but seldom of such a nature as to form valuable forests. They are for the most part short and poor in form, but grow to large dimensions in scattered patches, south from Gladstone. North from Ingham, the western fringe of the scrub belt (*a* in Fig. 14), on the high ranges, carries good eucalypts, but the belt seldom exceeds one mile in width.

"West from Rockhampton, on a high area near Dingo (Blackdown and Shotover Tablelands) very good eucalypt forests exist (see *e*), and the Expedition Range, as far south as Taroom, also carries good growth (*e*).

"North-west from Clermont there is another good patch of eucalypts (*d*), but generally speaking, north of Gladstone eucalyptus

* J. Thomson.

growth is poor; whilst the same holds good west of a line from Taroom to Goondiwindi."

The principal eucalypts are ironbark, grey, spotted and red gum, blackbutt and turpentine (*Syncarpia*).*

Small patches of good timber occur in the Northern Territory, along the Roper River and on the edge of the tablelands. These consist of cypress and melaleuca, as well as eucalypts. Similar conditions occur in the Kimberley regions of West Australia

TROPICAL RAIN-FORESTS.—These are even more restricted than the thick eucalypt forests. I have indicated on the map (Fig. 14, *a*, *b*, *c*), by the black areas, the size and position of the true tropical jungle areas of any considerable extent. They consist of the eastern portion of the Atherton Plateau (with a rainfall reaching 165 inches a year at Harvey Creek), and small patches of similarly watered country near Bowen and Mackay. South of the tropic, there rae other important areas extending south almost to Newcastle (N.S.W.), but these do not enter into this study.

The northern area contains many valuable cabinet woods, such as red cedar, maple, Queensland bean, silky oak, rosewood, etc. Several softwoods, such as Queensland white pine, are very largely sawn in the mills in the forests.

MINERAL AND ARTESIAN WATER.

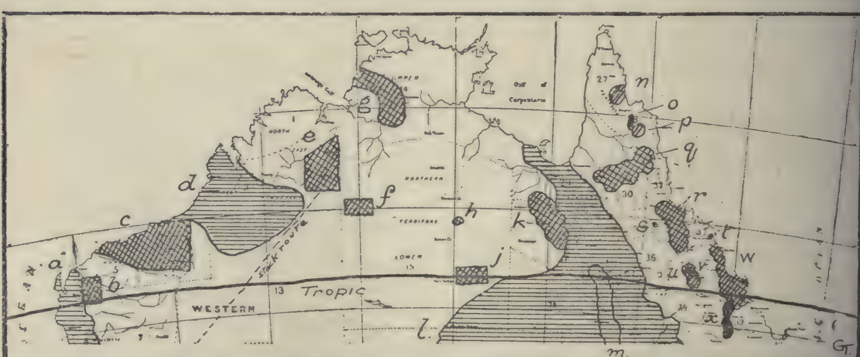


FIG. 15.—Mineral Fields of Tropical Australia.
a, d, l, Artesian Basins. m, Opal Fields. (ruled)
o, s, t, v, x, Coal Fields (black)
b, c, e, f, g, h, j, k, n, p, q, r, u, w, are Metal Fields (cross-hatched)

From the point of view of settlement (as opposed to national wealth), it is easy to exaggerate the value of our mineral resources, important as they are. The dairy lands of the Atherton Plateau,

* G. H. Knibbs, 1913. Year Book.

and the sugar cane of the Queensland coast, are bigger factors in settling our tropics than all the mines in Northern Territory, and the North of W.A. The mineral deposit which may do most in this direction, is the Dawson River coalfield (*x* in Fig. 15), which lies just on the tropics. Unfortunately, but for Clermont (*v*. on map), and a few small fields in North Queensland, no others of impor ance have yet been discovered. There are possibilities of good seams south of Derby (W.A.), and in or near the Victoria and Roper basins in the Territory.

With regard to metallic minerals, there are, of course, many famous mining areas, especially in Eastern Queensland; but mining becomes of less importance in the central and west tropical regions In Northern Territory there are only about 150 white men (1914) engaged in mining, and in tropical West Australia the figures are also very small.

The chief mineral areas are shown on the sketch map (Fig. 15). While it is true that a large mine like Mount Morgan or Broken Hill might easily be hidden in undeveloped country, yet it is probable that large areas of the tropics will never become mining fields. This applies to most of the undisturbed Paleozoic sediments investigated by Talbot to the south-west of Hall's Creek (*e*). The Cambrian (*i*) deposits in the south and east of the Territory have proved practically barren wherever they have been prospected, except in a few localities in the Eastern Macdonnell's (*j*.) and Davenport Ranges (*h*), etc. Again, the comparatively late deposits of the great artesian basin in Central Queensland (*l*), and the similar basin south-west of the Kimberley (*d*) are highly unlikely to furnish much in the way of valuable metals.

Neglecting less important "shows," the chief fields are shown in the following table:—

METALS IN TROPICAL AUSTRALIA.

State	Gold	Copper	Silver-lead	Tin	Others
W. Australia	Pilbarra (e) Kimberley (c) Ashburton (b)	Pilbarra		Pilbarra	Koolan I.
North Territory	Pine Creek (g) (Arltunga, (j) (Tanami, (f)	Pine Creek	Pine Creek	Mt. Wells Maranboy Brock's Creek (all g)	Rum Jungle Wolfram, C. Frew, R. (h)
Queensland	Charters T. (r) Ravenswood (r) Croydon (q) Etheridge (q) Cloncurry (k) Chillagoe (q)	Cloncurry Etheridge Chillagoe Mackay (w)	Chillagoe Charters T. Cloncurry	Herberton (q) Chillagoe Cooktown (p)	Wolfram Camp (q)

Letters refer to Map in Fig 15.

ARTESIAN WATER is of great value to a country, and there are two fairly extensive areas in the tropics which are shown on map 15. The desert basin south of Derby (W.A.) is approximately 80,000 square miles (largely unsurveyed)—while the narrow northern portion of the Great Basin in Queensland underlies about 60,000 square miles of tropical lands.

The deepest bore is 5,045 feet, to the south of Longreach, and, therefore, just outside the tropics. In the Winton district is the Elderslie bore, which is 4,500 feet deep, and provides 1,500,000 gallons daily at 10° below boiling point. Some Queensland bores give about 5,000,000 gallons daily. They have effected a marvellous change in the pastoral industry of Western Queensland. Stock increased from 10,000,000 in 1880 to 28,000,000 in 1913, and the larger portion of this progress is to be credited to the development of the artesian system.*

The best account of the remarkable development of shallow underground waters—which characterises most of our arid lands—is given by Talbot in connection with his survey of the stock route from Wiluna to Hall's Creek. There are thirty-two wells from the tropic (at Lake Disappointment) to Sturt's Creek, a distance of about 400 miles (Figs. 1 and 15.) Their general character can be gauged from the following table, which deals only with the wells within 60 miles of the tropic.

Well.	Depth.	Supply per hour	Remarks
18	16 feet	2,000 gallons	Sunk through travertine.
19	13½ ,,	2,000 ,,	In soft porous sandstone.
20	13½ ,,	2,000 ,,	Hollow between sand ridges.
21	51 ,,	150 ,,	. .
22	53 ,,	1,000 ,,	. .
23	19½ ,,	1,450 ,,	. .
25	37½ ,,	600 ,,	Near large clay pan.
26	23 ,,	2,016 ,,	Rises to within 10 feet of surface
27	24 ,,	300 ,,	In sandstone
28	30 ,,	840 ,,	Hollow in sand ridges.
Mujingerra	. .	. .	Natural tunnel 200 feet long.

These wells which are about 13 miles apart, will serve to keep open the stock route through almost the worst area in Australia. Talbot writes, however :—" Although at some future date the country along the lower portions of the Sturt may become settled, the country

* G. Harrap, 1916. Geography of Queensland.

along the stock route south of that point, owing to its inhospitable nature, is never likely to become occupied by pastoralists."†

PASTORAL RESOURCES AND SUGAR.

PASTORAL RESOURCES.—These are, undoubtedly, the chief assets of tropical Australia. Sufficient development has taken place to enable the geographer to classify the best areas, and to determine the regions where future increase is most probable.

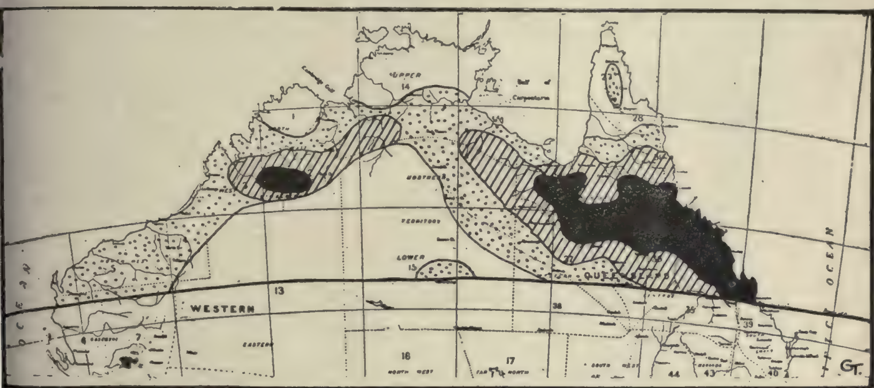


FIG. 16.—Distribution of cattle (about 1912). Very numerous, black ; medium, ruled ; sparse are dotted.

In Fig. 16 is shown the distribution of cattle about 1912, and there has not been much alteration since. Rockhampton has the densest distribution, but all along the Northern Railway in Queensland there are about 20 cattle per square mile over large areas. On the Fitzroy River in West Australia, a similar density obtains. In other regions of the tropical division, the density is much less ; and there are practically none in the wettest regions over 50 inches per year) and in the driest regions (less than 10 inches).

Hence, the best cattle country is determined primarily by the rainfall, and lies between the 15 and 40 inch isohyets—the 20 inch being perhaps the optimum. Assuming that the newer northern and western regions progress along similar lines in the future, then a glance at the rainfall map (Fig. 8) shows that the chief advance will be made in Kimberley (W.A.) and Northern Territory.

There is, of course, some rivalry between cattle and sheep. The latter pay better on country which is suitable for either—but in the wetter and warmer coastal regions the hardier cattle do better than

† H. Talbot, 1910. Bulletin 39. Geological Survey of W.A.

sheep. Moreover, they can travel further for water, and live on rougher feed—so that our newer territories will probably be developed as cattle stations in the first place.

Dairies will continue to multiply in such regions as the Atherton Plateau, where there were 450 in 1913, and along the Central Queensland coast. But the " Rainfall Uniformity " map (Fig. 9) shows that, except in Eastern Queensland, the long dry winter is likely to prevent extensive dairying in any other portion of our tropics. Some experiments in dairying are however, being tried at Darwin.

It is worthy of note that the Indian buffaloes do well in the wettest and hottest regions of Australia, where ticks, disease and coarse grass have, so far, given great trouble to European cattle.

In Fig. 17 is the corresponding map showing the distribution of sheep in tropical Australia. They are densely congregated near

FIG. 17.—Distribution of Sheep (about 1912). Very numerous, black ; medium, ruled ; and sparse dotted.

Longreach, in Queensland, but do not bulk largely at present anywhere else. The Barkly Tableland, however, grazes over 50,000 at Avon Downs, and there are about 10,000 in the Macdonnell Ranges, while an experimental flock of 2,000 is progressing satisfactorily at Mataranka far to the north. With increased facilities, we may expect the sheep belt to spread across through the Territory along the 20 inch isohyet, to meet the valuable sheep tracts on the lower Fitzroy in West Australia. It seems doubtful if the rougher wilder country of the tropics will be used for sheep until present conditions have almost disappeared, and the chief immediate extension of the sheep country will probably occur rather in temperate regions.

SUGAR INDUSTRY.—In Northern Queensland, between the tropic and latitude 15° S., there is a thriving industry which is of special interest, because it appears to be the only important example of

tropical agriculture carried out by British labour. Over 27,000 white people are engaged in this industry along the north-east coast of Australia, from Grafton (N.S.W.) to Cairns, in Queensland.

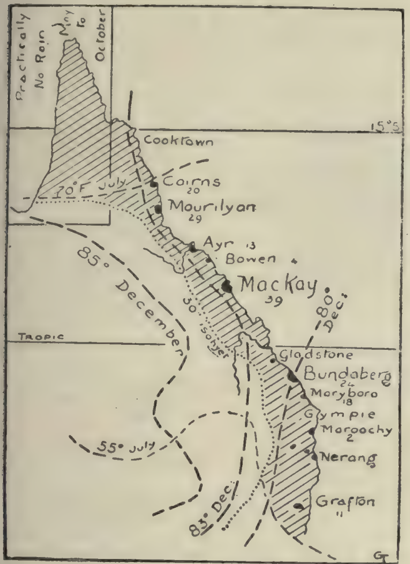


FIG. 17a.—The Sugar Region in Queensland, shown by black areas (figures are thousand acres). Controlling isotherms in January and July are given, and also the 30 inch isothyet.

In Fig. 17a, the climatic controls governing the crops are indicated. The rainfall control is the most important, and confines the plantations to the coast, where the rainfall (or equivalent irrigation) exceeds 40 ins. per year. The southern limit is determined by the temperature in the coldest month. Grafton is, of course, far south of the tropic. The northern boundary is probably fixed in Queensland, by the fact that in Cape York Peninsula—though the total rainfall is abundant enough—it is not uniform enough, and for the six winter months in the year very little rain falls north of Cooktown. (See Fig. 9).

The map (Fig. 17a) shows that nearly twice as much sugar is produced in the northern tropical coasts as in those south of the tropic. Mackay is the chief centre. Here there were 39,050 acres devoted to sugar, and the yield for 1915 was about 30,000 tons of sugar. The total for the tropical coasts was 103,000 tons of sugar.†

This section closes the brief survey of the economic resources of the tropics. Space does not permit of reference to the pearling industry, but the possibilities of wheat, cotton, tea, coffee and rice are set forth in the Comparative Study, which follows.

PART II.—COMPARATIVE STUDY.

At first glance, it would seem simple to find those natural regions in other parts of the world which closely resemble the several divisions of our tropics. Such similar regions have been termed *homoclines*, a term which I shall use extensively.

† Queensland Statistics, 1915.

The Australian tropics are characterised by a hot climate, and by a typical summer rainfall of length varying according to position. Thus, the East Queensland coast and hinterland really merit separation from the northern and western portions, with their long dry winters. Let us glance at the other chief tropical regions, and see if they agree with the area under discussion.

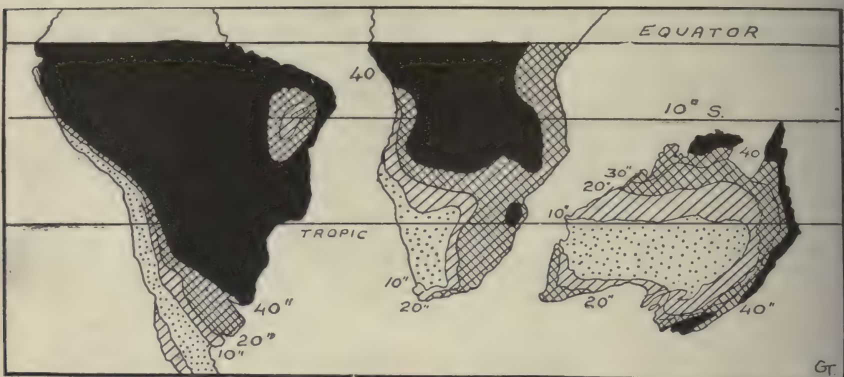


FIG. 18.—The Three Southern Lands, similarly placed with regard to the Tropic (black areas over 40 inches rain)—showing the great aridity of Australia. South America is too wet north of the Tropics, while South Africa is too elevated (and wet) to compare closely with Tropical Australia. (See, however, Fig. 29 for Eastern Brazil).

Let us consider first the analogous southern regions of Africa and America (see Fig. 18). In this map, the regions of heavy rainfall (over 40 inches) are shown *black*. We see that the whole of South America, within the tropics, is a region of heavy rainfall, and possesses little that can help us to understand the future of our drier pastoral lands. Only in Eastern Brazil is there a small area which perhaps parallels portions of our north coast.

In Africa, the analogy seems closer. There also is the wetter north and east, and the desert region in the west. But, as we have already learned, this section of Africa is distinguished by a very great average elevation to which Australia offers no parallel (see Fig. 7.) So that here again, except for some of the coastlands, we have little to learn by direct comparison.

The country that most appeals to us as advanced in ideas and inventions is U.S.A. Curiously, the areas are almost exactly the same, being 2,970,000 square miles. It is unfortunate for Australia that she lies some 10° nearer the Equator, or we might hope for a virile race of 100 million white Australians in the near future! But Fig. 19 shows that there is no comparison in their resources. The

two regions are here similarly placed with regard to the tropics, and it is seen that the whole of U.S.A. lies far north of the Tropic of Cancer. Even Florida and New Orleans—which are never considered ideal regions for white farming, are further from the Equator than Geraldton (W.A.) or Brisbane.

FIG. 19.—Australia and U.S.A. similarly placed with respect to the Tropic, showing broadly the analogous areas of land. Black areas are arid (under 10"). Ruled area in U.S.A. is thickly settled (over 18 to sq. mile), and has over 20 inches of rainfall. The similarly watered (but sparsely settled) region in Australia is shown by broken ruling. No portion of U.S.A. resembles our Tropical lands.

The topography of North America is very different. Had there been a lowland in the west—as in Australia, there is little doubt that their arid area would have somewhat resembled our huge extent. As it is, their arid region is only 1/10th of the whole, instead of one-third, as in our continent. Of great interest is the striking example offered by U.S.A. of the supreme importance of the rainfall control. The farming country lies almost wholly in the east, and comprises the close settlement areas. It is bounded almost exactly by the 20 inch isohyet. To the *east* of this line the country contains over 18 persons to the square mile, while to the *west* the density is less than two to the square mile,

In Australia, the regions where we expect similar growth, are confined to the cooler temperate portions. They are shown in Fig. 20, but do not further concern us.

It is when we compare Australia with the Indian and Persian regions that the parallel seems to be closest. I have developed the thesis that Australia is not cooler than most similarly situated lands, earlier in this paper—so that few should cavil at the position

assigned to Australia in Fig. 20. Here the agreement between the hot, wet Wyndham region, and the hot, wet Tinnavelli region, is marked. Again, just on the polar side of the tropic in both countries,

FIG. 20.—Australia superposed over India, showing a striking similarily in hot regions and arid regions. Indian desert shown dotted, Australian blank; a b and c d are the Wyndham and Tinnevelli regions respectively.

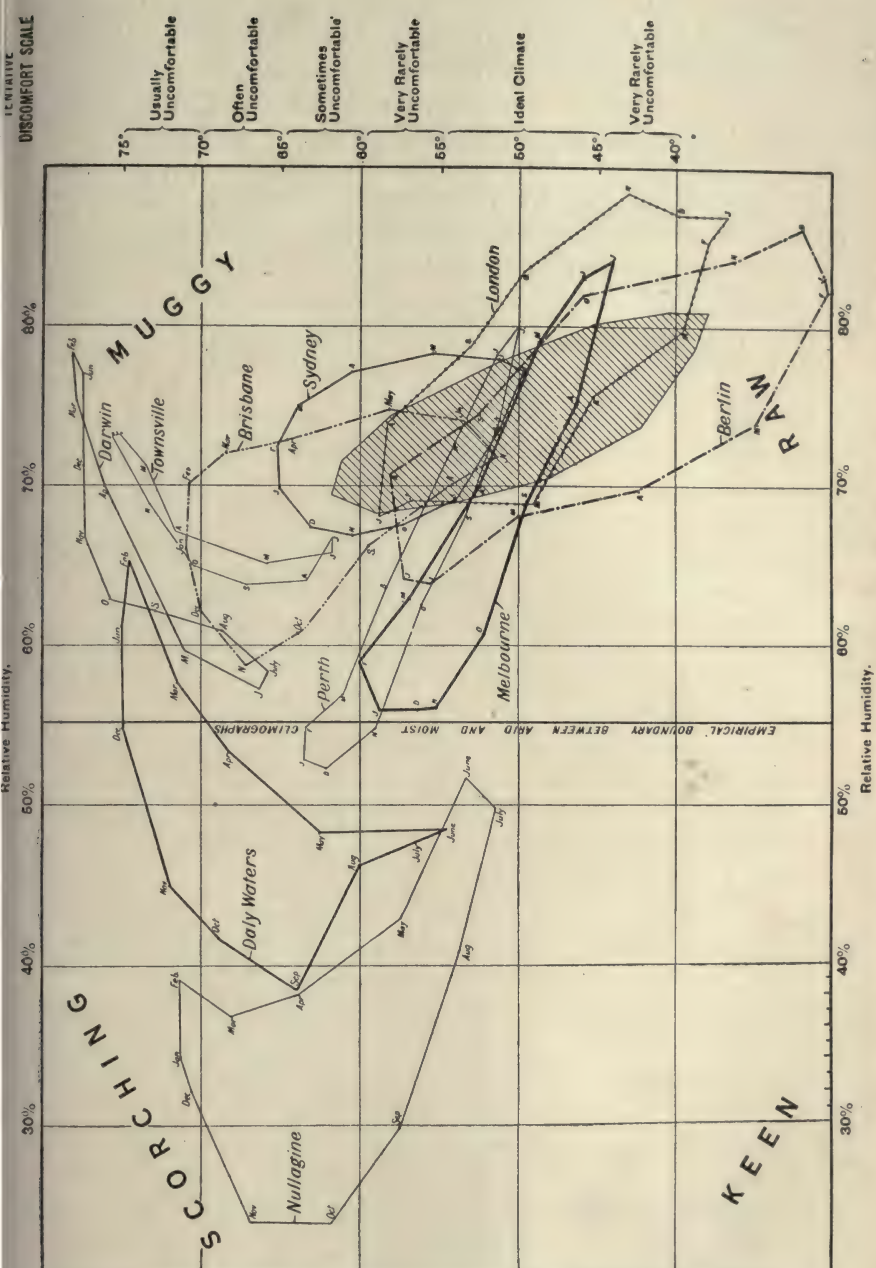
occur the desert areas, those of Central Australia and the Thar respectively. They are seen to agree remarkably also. Of course, the Himalayas have no parallel in Southern Asutralia, but that is of little moment for the purpose in view.

It is, therefore, evident that it is in Southern and Central India that we get parallels to most of our tropical regions, and any student of Australia's future will do well to ponder on all that this implies.

COMPARATIVE CLIMATOLOGY.

A method has been evolved of comparing the climates of two countries with special reference to their adaptability for white settlement. Briefly, it consists in drawing *climographs* for any two localities which it desired to compare, and finding their relation to each other, and to certain standards which are generally known.

The two elements which seem to most closely control health and comfort are the wet bulb temperature, and the humidity. These are tabulated for a given place, and the figures for each month are plotted (on a graph-chart having wet bulb and humidity as ordinates). Thus, a twelve-sided polygon is obtained, whose position on the chart can be compared at a glance with other similarly drawn climographs.

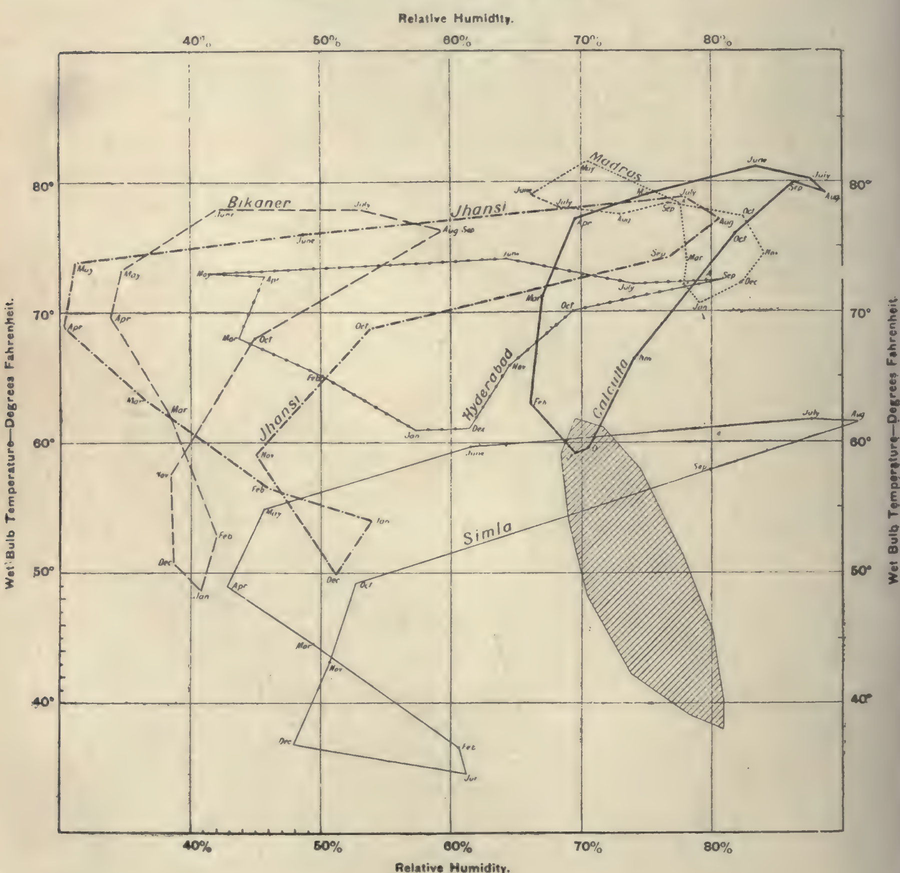


NOTE.—The shaded figure is the composite white race climograph based on twelve typical cities.

FIG. 21.—Climographs for Australia, showing how the localities approach the four types of discomfort. The shaded climograph shows the most habitable type for the white race (The Wet-Bulb Discomfort Scale is at the right).

On Fig. 21 such climographs for towns in Australia are shown. The tropical examples range from Nullagine (which is in the *scorching* quadrant) to Darwin (which is in the *muggy* quadrant). In the lower right corner is a composite climograph based on twelve of the chief centres of white settlement in both hemispheres. According as the tested climograph covers, or is remote from this criterion—so the place suits or is opposed to close white settlement. Melbourne is seen to be preferable to Sydney, and Sydney to Brisbane, while none of the tropical towns in any way resemble the average conditions of the centres of our race.

CLIMOGRAPHS FOR INDIAN MONSOON REGION.



NOTE.—The shaded figure is the composite white race climograph based on twelve typical cities

FIG. 22.—Climographs for India. The ruled climograph shows the most suitable tyne for the white race.

The figure also indicates a tentative "discomfort scale," based directly on wet bulb data. This scale is in an experimental condition, and the reader is referred to my original memoir for its limitations and advantages.*

The average Australian will probably be little impressed by this admittedly arbitrary scale of discomfort. But he will be able to see (from Fig. 22) that the towns of Southern and Central India, plotted according to similar rules, come out in closely similar positions on the chart. Thus, Jhansi and Bikaner, the hottest and driest places in India, are no worse than Nullagine and Daly Waters, while Calcutta and Darwin have many points of resemblance, though the summer is more humid in Calcutta.

The study of such comparative records should show us that climate offers many handicaps to manual labour in our northern tropics. Whether our comparative freedom from diseases, and our immunity from the competition of black labour, are sufficient compensations, is a problem for the future to decide.

In the following table I give further homoclines for our tropical areas, and a short note on this question of colonisation by inferior races will be found in the concluding sections.

HOMOCLIMES OF AUSTRALIAN REGIONS.

AUSTRALIAN.

	Station.	Lat.	Rainfall.			Temperature.		
			Average.	Wettest month	Driest month	Average.	Hottest month	Coldest month
A	Broome, W.A. ..	18° S.	22.9	6.3	0.3	79.8	85.9	70.3
	Nullagine, W.A ..	22° S.	12.7	2.7	0	76.4	89.8	59.3
B	Carnarvon	25° S.	9.0	2.8	0	71.1	79.8	60.6
C	Darwin	12° S.	62	15.3	0	82.6	84.2	77.2
	Daly Waters ..	16° S.	27	6.7	0	80.4	86.9	68.6
D	Alice Springs ..	23° S.	10.9	1.7	0.4	69.8	84.0	52.5
	Tennant's Creek ..	20° S.	14.6	3.0	0	77.3	86.0*	60.0*
E	Townsville	19° S.	48.6	11.5	0.5	75.7	82.1	66.6

* Approximate.

* **Bulletin 14, Weather Bureau, Melbourne, 1916.**

FOREIGN.

	Station.	Lat.	Rainfall.			Temperature.		
			Average.	Wettest month	Driest month	Average.	Hottest month	Coldest month
A	Banana (Congo) ..	26° S.	29.0	6.0	0	77.9	81.5	72.5
	Colima (W. Mexico)	20° N.	34.0	7.0	0	76.1	80.9	69.5
B	Swakopmund (S.W. Africa) ..	25° S.	0.8	0	0	67.1	62.6	55.2
	Olukonda (S.W. Af.)	18° S.	19.5	5	0	72.5	76.6	60.9
C	Bathurst (Gambia)	13½° N.	48	20.5	0	77.3	80.6	73.7
	Cuttack (E. India);	20° N.	55	12.4	0.3	80.3	89.0	69.0
	Quixeramobim N.E. Brazil) ..	5½° N.	24	6	0	81.1	83.1	78.9
D	Windhoek (S.W. Af	22½° S.	14	4.5	0	67.0	74.8	55.9
	Peshawur (Punjab)	34° N.	13	2.1	0.1	71.0	90.0	50
	Biskra (Algeria) ..	35° N.	10	1.5	0	69.3	89.0	51
E	Calcutta	24° N.	60	12.3	0.3	77.9	82.4	65.2

N.B.—The Australian localities in Class A are to be compared with their *foreign* homoclimes in Class A, and so on. Hence a homoclime of Townsville is Calcutta.

TROPICAL PRODUCTS.—This paper does not pretend to describe political aspects of the problem, so that I shall here ignore the question of the supply of agricultural labour, and discuss briefly the suitability of our tropics, *per se*, for such important products as wheat, rice, cotton, tea, and coffee.

In this case (as in the study of human comfort already briefly discussed) it is helpful to use the graphic method. The two chief controls which determine the suitability of a region for plant life are temperature and rainfall. (Soils are of great importance, but in the huge tropical tract which we are considering, we know of hundreds of acres of fertile river flats which have never been developed in the slightest—so that the soil can be assumed satisfactory). The seasonal *variations* in heat and moisture are also of great importance, and the method to be described seems to illustrate this very satisfactorily.

To the graph representing these controls I have given the name *hythergraph*, from the Greek words for *rain* and *heat*. The graphs are drawn just as were the climographs, but on ordinates of rainfall and temperature.

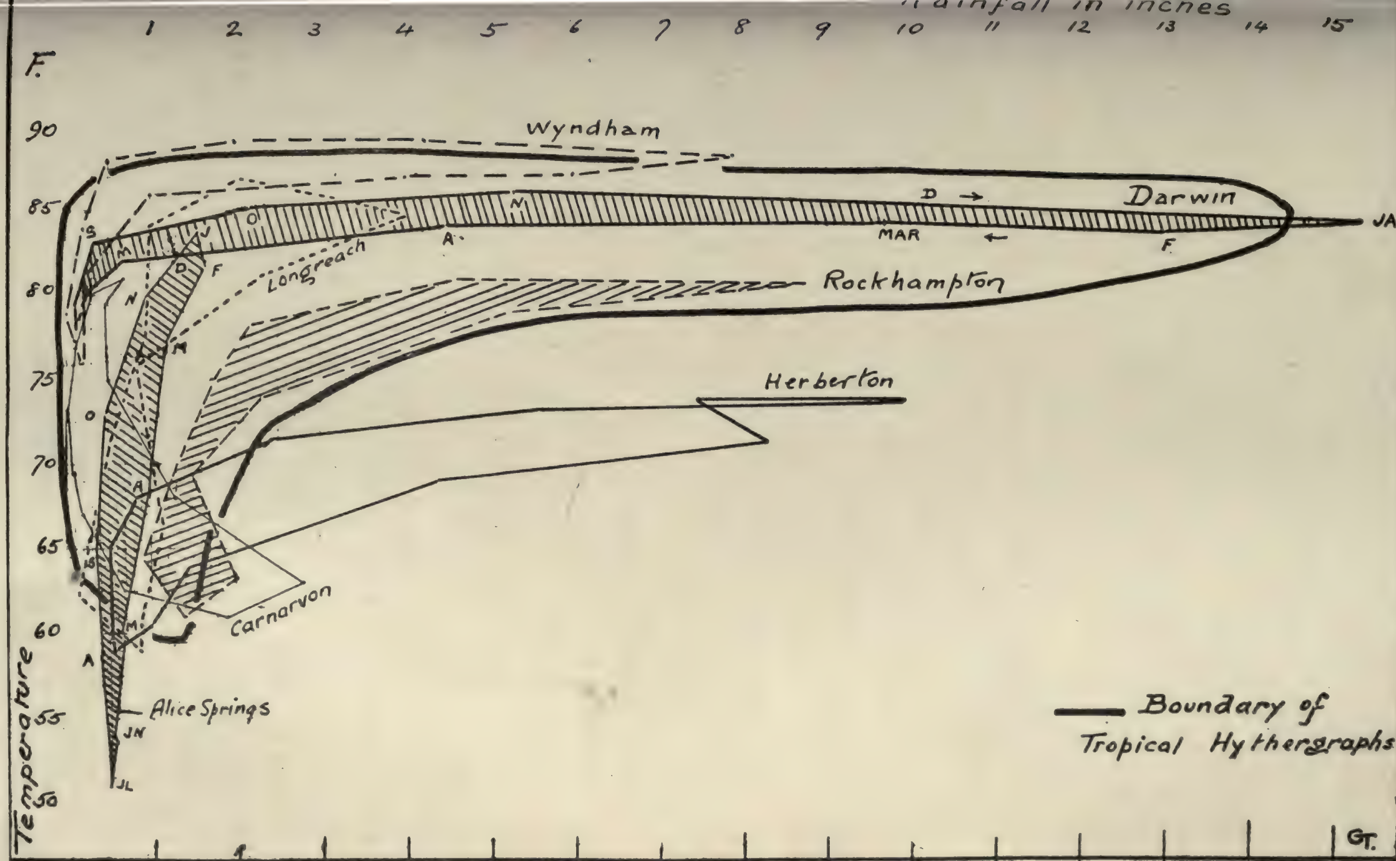


FIG. 23.—Typical Hythergraphs for Tropical Australia. The initial letters refer to the months. Horizontal distances represent rainfall *per month*. Wyndham represents the hot north-west coast, Carnarvon the dry south-west coast, Darwin the hot wet north coast, and Rockhampton the hot wet south-east coast. Alice Springs is in the arid interior. Longreach is good inland sheep

In Fig. 23 the hythergraphs for typical localities in the Australian tropics are given. If we look at the graph for Darwin, we see that it lies almost wholly on the 83° temperature abscissa. This is what one would expect from its position near the equator. The rainfall range is very great—from 15 inches in January (*J*) to negligible amounts in midwinter. As we move southward, the hythergraph changes to the opposite type, which is illustrated by Alice Springs. Here the rainfall varies but slightly from 50 points to 150 points per month ; but the temperature range is great, from 83° F. in January (*J*) to 51° F. in July (*JL*).

Intermediate localities partake somewhat of both types. Thus Rockhampton has a hot season resembling Darwin, with constant temperatures (about 77° F.), and very variable rainfall ; and a cooler season with more constant rainfall (1 to 2 inches), and very variable temperature (from 60° F. to 75° F.) Longreach typifies the inland towns, and approximates to the Alice Springs type. Hall's Creek and Cloncurry have the same kind of hythergraph, but are not plotted. Emerald (in East-Central Queensland) is shown on Fig. 24. Carnarvon shows the presence of some winter rain—for the axis runs across the direction of most of those plotted. It is the driest coast town in Australia (9inches a year), and is just south of the tropic in W.A. Wyndham is the hottest town in Australia, and has a typical summer rain hythergraph.

The unusually satisfactory conditions on the Atherton Plateau in North Queensland are illustrated by the hythergraph for Herberton. This belongs to the summer-rain type, but owing to its elevation of nearly 3,000 feet, it is almost 10 degrees cooler than Rockhampton—far to the south. It is a thousand pities that we have not more of these tropical plateaux. As we shall see many valuable crops would grow excellently there.

A similar set of hythergraphs could be drawn from any continent ; and it would be found that they would cover a very much larger range of temperature and rainfall than do the Australian examples Omitting such unusual localities as Innisfail (with 26 inches in March) and the Herberton type, which is all too restricted, we can enclose 99 per cent. of our tropical hythregraphs in a heavy black border shown in Fig. 23. This can be reproduced on other hythergraphs, and will act as a standard of comparison.

Let us first see how the hythergraph method helps us with regard to wheat possibilities. In Fig. 24 many typical wheat localities are plotted, and their position with respect to the aforesaid "Australian boundary" can be seen at a glance.

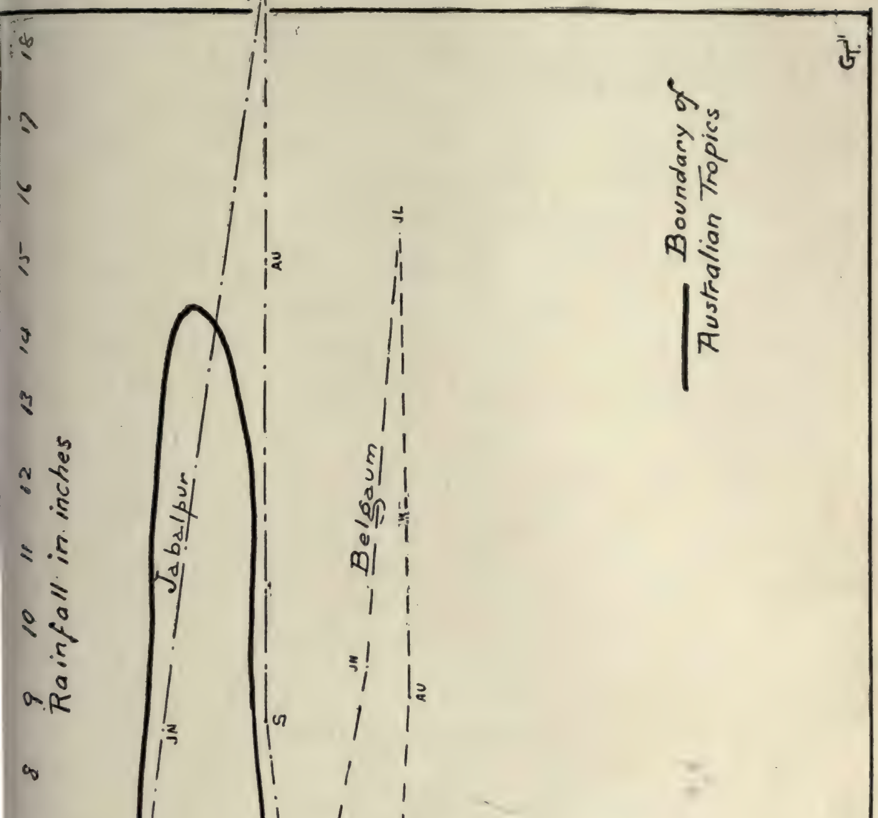


FIG. 24.—Hythergraphs for Wheat. The Wheat of temperate regions closely resembles the Oklahoma (U.S.A.) graph. Hot-climate wheat grows at Lahore, Jabalpur and Belgaum in India, and at Corrientes (Argentine). Emerald (Queensland) is inserted for comparison. The heavy black line is taken from Fig. 23.

The chief wheat lands of the world are in U.S.A., South-East Europe, and India. If we plot type localities we find that there is a big range of possible controls (especially in rainfall) in some of the less important regions. But Minneapolis, Oklahoma, Bucharest, and Albury (N.S.W.), to choose four well-known regions, are all of the type shown by the Oklahoma hythergraph. There is great range of temperature, but not so much range in rainfall. The wheat is often planted in the autumn, and lies dormant during winter, to start vigorously in spring, and be harvested about midsummer.

But there is another type of wheat harvest, and this is the one which concerns our tropical lands. In India the wheat is sown at the end of the hot weather when the heavy rains are over, and depends chiefly on the moisture in the soil rather than on the rainfall during growth (though this also helps of course). Under these conditions wheat is grown so far south as Southern Bombay (near Belgaum 16° S., and 2,000 feet elevation), and more largely near Jabalpur on the tropic. The typical area is, of course, in the Indo-Gangetic plains, and Lahore will serve as an example. The wheat is reaped at the close of the cold weather, in April or May.

The northern limit of extensive wheat culture in Australia lies at present in latitude 26° S., or well south of the tropic. But there is no climatic reason why special wheats should not grow very much farther north in the Queensland hinterland.

The chief Indian wheat areas have an average temperature of from 75° to 79° F., while in the growing period the temperatures range from 64° to 71°. These latter temperatures are precisely those of Eastern Queensland. Thus, in inland Queensland, south of Bowen —the region from Mackay to Charleville has the same dry winter and spring, with only 5 to 10 inches of rain.

Emerald (on the tropic) receives 14 inches of rain in the wet season. The wheat might be grown on the Indian method, *i.e.*, sown early in March. It would ripen in about four months, before possibility of frost or severe cold, and would receive therein an additional five inches of rainfall.—The hythergraph for Emerald is shown on Fig. 24, where it is seen to lie midway between Lahore and Oklahoma.

A similar warm-wheat region is illustrated by the graph for Corrientes (in Northern Argentine). Here, however, the average rainfall is considerably greater.

It will be seen that the Herberton district is closely paralleled by Belgaum in the higher portion of Southern Bombay ; while Jabalpur is, to some extent, a homoclime of Darwin, and shows that it is

possible to grow some wheat even in such a tropic region as this. But it must be remembered that in India these conditions of rain and heat are general over large plains and extensive plateau of rich river-alluvial or decomposed volcanic debris. In tropical Australia such extensive areas are non-existent; and, speaking generally, the northern wet regions seem, unfortunately, to be either rather poor in plant food, or else very restricted, if fertile.

While recognising that these theoretical considerations are of much less value than practical tests, which the various authorities are beginning to carry out, yet I hope that the above discussion will be novel and of value as regards potentialities and comparisons with the homoclimes elsewhere. At any rate these graphs deal with average conditions which cannot be tested in the field until many years have elapsed.

Hythergraphs are shown for rice and tea in Fig. 25, with the addition of the "Australian boundary line," to act as a criterion. Rice is grown (usually, of course, with irrigation) in great quantity near Calcutta, whose graph is seen to resemble closely that for Darwin or Cairns, near which suitable river flats occur. There is, however, in Australia, no tropical region with a climate resembling that of New Orleans, where also large crops of rice are grown. When we remember that rice is grown satisfactorily in Northern Italy, we realise that this plant has a tremendous range of habitat, and will, undoubtedly, flourish anywhere in our tropics where rainfall and soils are suitable.

As regards tea, it is suited by cooler and wetter conditions for the most part. The homoclimes of Kandy and Formosa suggest the Atherton Plateau as the only promising field. But the great temperature range successfully resisted by Japanese teas (see Osaka graph) seems to indicate a field for tea in South-East Queensland, just south of the tropics.

Coffee is illustrated in Fig. 26. The graph for Juiz is very close to that of Herberton—as we should expect, for coffee has been grown in the latter district. Juiz lies 100 miles north of Rio, in Brazil (see Fig. 29), in the centre of the chief coffee district in the world. The hythergraph for another coffee region—Mysore, in Southern India—is also given. This is one of those elevated tropical regions in which Australia is so deficient.

Cotton is a crop which grows under conditions somewhat reminding one of those for wheat. In U.S.A., the great cotton belt experiences much cold weather, as is evident from the hythergraphs for Waco (Texas) and Atlanta (Georgia). But there are also large crops of *tropical* cotton—such as those of Central India. I show

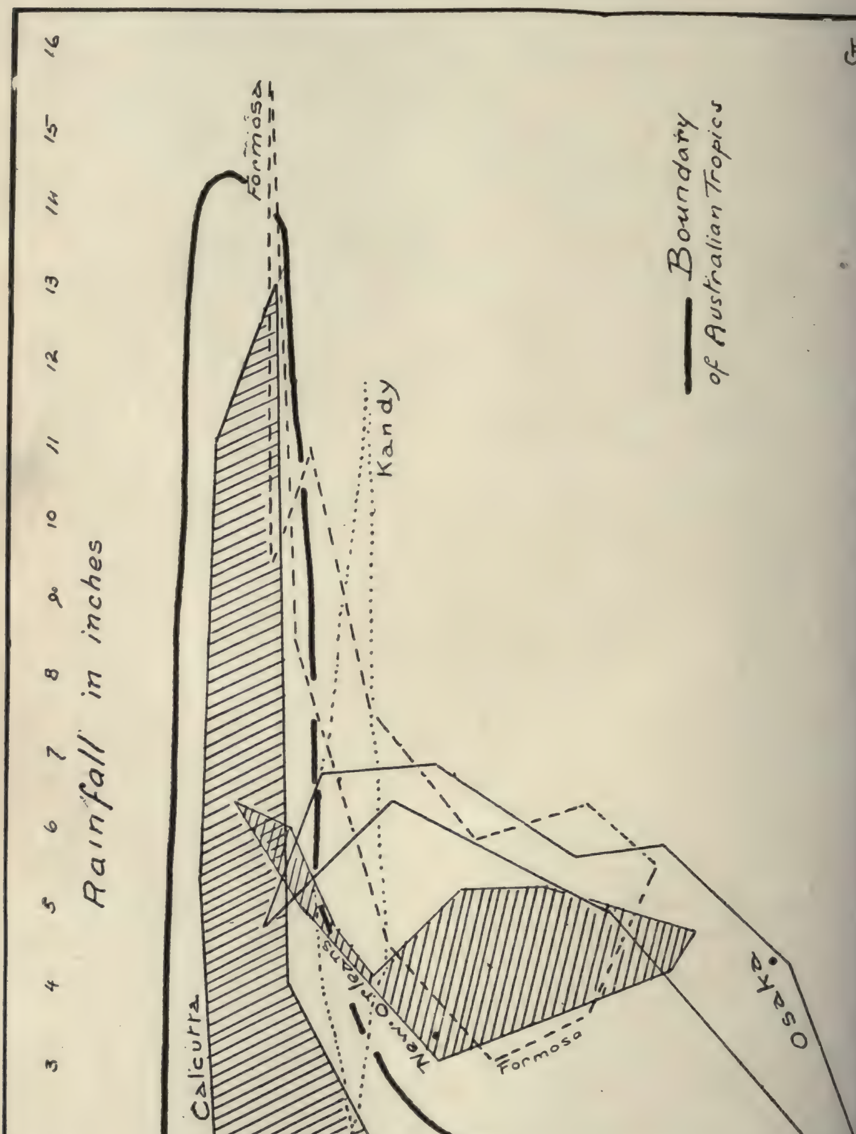


Fig. 25.—Hythergraphs for Rice (Calcutta and New Orleans) and Tea (Kandy as in Ceylon, Formosa in China, and Osaka in Japan.)

the graph for Nagpur (21° N. latitude), which is sufficiently like those of our wetter tropical coastlands, to be very encouraging.

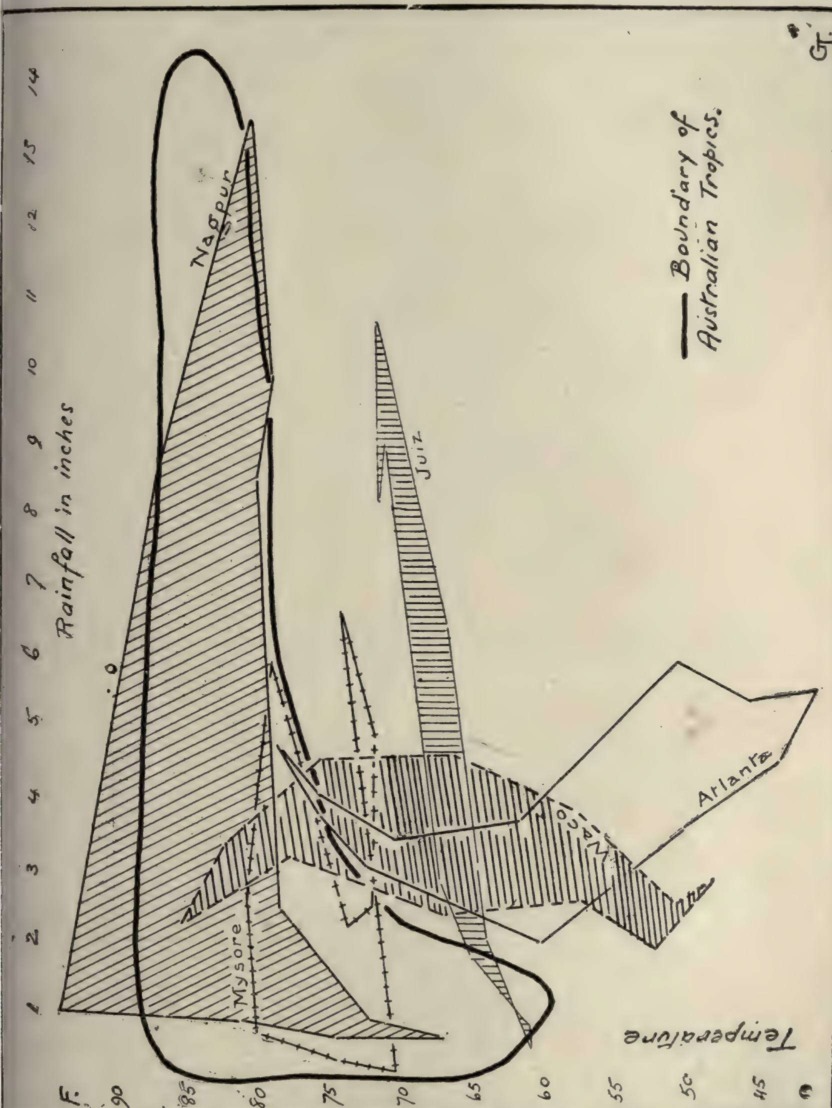


FIG. 26.—Hythergraphs for Coffee and Cotton. Atlanta and Waco are great cotton centres in U.S.A. Nagpur shows a tropical cotton area in India. Juiz (Brazil) is the centre of the chief coffee area. Mysore shows a hill coffee area in S. India.

CROPS IN NORTHERN TERRITORY COASTLANDS.—The graphs discussed above will serve to show how the climate compares with those of other analogous regions of agricultural importance But mention must be made of the lengthy experiments on tropical agriculture carried on near Darwin.

At Bachelor, the following crops were grown on a fairly substantial scale during 1914 and 1915 Cowpeas for fodder and manure, 50 acres of rice, 25 acres of maize, 14 acres of lucerne (which was choked by the rank grass), 12 acres of Hungarian millet, and 3 acres of wheat. The early onset of the dry season seriously affected most of these crops, especially the wheat.

At Daly River, corn and cowpeas were grown, and numerous pigs flourish on the native lilies in the billabongs. At the Botanic Gardens, there were experimental plots of coffee, ground nuts, cassava and varous types of rice, which have given encouraging results.

Of these crops, the Administrator writes:—"Purely tropical products, as grown in other similar parts of the world, such as cigar tobacco, sisal hemp, cotton, tea, coffee, etc., are obviously out of the question here, where abundant cheap labour is unobtainable. Efforts, therefore, must be directed towards those crops (rice, etc.), which may be grown by aid of labour-saving machinery." He remarks that an agricultural labourer, who has anything to do with farm machinery, expects £4 per week. "I know of practically no soil (save very rich soils close to great centres of population) which, at any rent or no rent, will enable agriculture to be conducted in such circumstances."*

THE RACE ASPECT.—Some observations on this side of the question may be of interest, although they touch on political as well as geographical principles.

The subject of white colonisation of the tropics has been treated fairly fully, considering how handicapped it is by lack of evidence. The only tropical regions of any extent colonised by white peoples are the Soudan, Abyssinia, and Southern Arabia—and the white peoples concerned all belong to the Semitic and Hamitic branches of the Indo-Aryans. The Syrians, who are occasionally met with in Australia, are members of this important group.

Elsewhere the Aryan race is comparatively unimportant. The Indians of Bombay, the Portuguese and Spanish of tropical South America, practically exhaust the list. Our own country—especially Northern Queensland—is the only important tropical area settled by Northern Europeans, so that the evidence furnished in this region is of especial value. It is, however, to be noted that there is little settlement within 16° of the Equator in Queensland.

Ripley, the distinguished ethnologist, who has studied the migrations of European races in great detail, is a profound pessimist as regards settlement of the tropics in general by Britishers. He

* Northern Territory Report, 1915.

writes :—"To urge the emigration of women and children, or any other save those of most robust health, to the tropics, may not be murder in the first degree, but it should be classed (to put it mildly) as incitement to it."

As usual in these cases, the truth never lies with the extremists, and we shall do better to consider conditions in South America, where a European race has settled for several hundred years in the tropics. Bryce gives an interesting picture in his book, "South America" (1912). He states that of the 45 millions of inhabitants, there are 15 million whites, 8 million Indians, 13 million Mestizoes, 6 million mulattoes and 3 million negroes.

The "Indians" of South America are, of course, an early offshoot of the yellow race; so that the Mestizoes (or progeny of South Europeans and Indians) offer abundant examples of the power of a white-yellow hybrid to colonise the tropics. Bryce writes :—"In the mixed race, the white element seems usually to predominate. I do not state this as a physiological fact. But it is true as a social fact. That is to say the Mestizo deems himself white—tries to live and think as white, and is practically recognised by others as white. . . . . It may seem natural to assume that such mixed nations will, in respect of their aboriginal blood, be inferior to their European relatives, but this is mere assumption. The Chilean peasant to-day, who is at least half-Indian, is not inferior to the Argentine peasant, who is almost pure white."

It is the race fusion which has made Latin America possible in tropical regions; and it is a sad accident that the whole question of mixed races has been so largely prejudiced by the over-shadowing black problem in U.S.A.

If we glance at a map of the tropics, as settled by the yellow races (see Fig. 27), we are struck by the fact that all such tropical lands have an abundant rainfall, which differs greatly from that of our tropical areas. Only the merest fringe around Darwin and Cairns recalls the lands of Java, of Borneo, of Siam, and Southern China. They are nowhere indigenous in regions with a hot, dry climate, such as our hinterland, or Rajputana.

The White Australia policy—for good or evil—effectually blocks all settlement by Mongols, Indians, or half-castes. In connection with the last type, some mention should be made of the Dutch half-castes of the Isle of Kissa. This lies off Timor (See Fig. 27) and only 400 miles north-west of Darwin.* In 1665 (according to Professor Macmillan

* MacMillan Brown, 1912, in "Sydney Morning Herald."

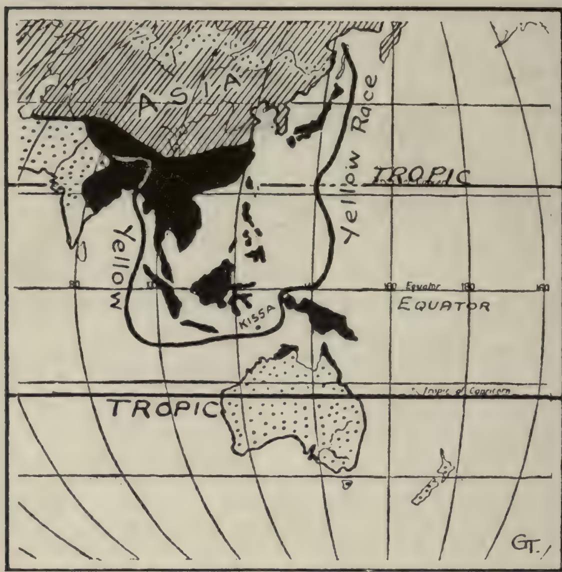


FIG. 27.—The Yellow Race in the Tropics. They have settled exclusively in regions receiving over 50 inches rainfall per annum (shown black). Only the regions immediately around Darwin and Thursday Island and Cairns have a similar climate in Australia.

Brown, of New Zealand), eight Dutch soldiers were abandoned here. Their progeny, numbering 300, still inhabit Kissa, and often have light hair and blue eyes, though the skin becomes as dark as that of an Italian as these fairer individuals grow up. Professor Brown's conclusions are of much interest to Australians. "The main cause of their vitality and vigour I take to be their dry and barren islet (which is only six miles long, and yet supports 6,000 people) compelling them to work if they are to live. Droughts are bad, and eliminate the unfit. In the tropics, moist heat is on the side of luxury and idleness, and it reinforces our natural inertia and longing for ease. The dry heat of the Australian plateaus interferes little with that vitality and energy which make life a healthy pleasure. As long as human life keeps to the plateaus in tropical Australia, and is bred in moderately hard conditions, it will not cease to perpetuate itself in a vigorous posterity. That is the lesson of Kissa."

Since settlement is to be confined to the white races, two courses seem open to us. Ravenstein has answered the question as follows :—

"If the white man is ever to occupy, permanently, the tropical parts of the world, it will have to be done by stages—each stage making a generation of men. For instance, in Eur-Africa, a steady stream

is setting southwards. Germans and Belgians are pouring into France, Frenchmen are going to Algiers, Arabs to the Soudan, and the Soudanese are pushing forward into Bantu Africa."

It might be possible to accelerate this migration over some stages, and to introduce those Europeans who are most fitted by previous environment into our tropical coastlands. These would undoubtedly be the Spanish, Italians and Maltese. They would obviously be several generations ahead of any British immigrants in the required cycle of climatic evolution. Unfortunately, they tend to leave their wives at home in Europe*, and as Dr. Gilruth points out), though they are paid extremely high wages in the Territory, ostensibly to support their families there, the money largely goes out of Australia. This method of settlement has not, therefore, helped Australia very largely up to the present

And so we are left to the alternative. It is a perfectly natural method, and one that would have a chance of success if the world were not already a welter of nations, jostling each other in their need for a place in the sun. As foreshadowed above, the method consists merely in a slow migration from cooler to warmer regions accompanied by generations of gradual acclimatisation.

In my own experience, I have passed through the stage necessary to accustom an Englishman from Sheffield (which has an annual temperature of 48° F.) to the climate of Sydney (with an annual temperature of 63° F.) This is merely a matter of a few years—though longer for middle-aged folk. A less period is necessary for the Englishman in Melbourne—none at all in Hobart. But when the uniformly hot climate of the tropics is entered, a very different period of acclimatisation is needed.

The average white settler has not yet become accustomed to the worst months of the North Queensland coast. It may become easier for his children, but it is undeniable that infantile mortality is much greater in the tropics than in cooler regions. It is this latter fact which makes the experiment so protracted and so costly. A strong vigorous Englishman with a respect for the rules of hygiene, can exist in some comfort in any region, from the Equator to the Pole; but not until he can rear his children in the tropics, with no higher a death rate than in more favoured regions, can it be stated that he has properly conquered the tropics. Needless to say, this happy state has not yet been approached; and we can only hope that time—that indispensable factor—will be granted to Australia to carry

* Dr. Thomson tells me that Italians with their families are settling permanently in the sugar areas north of Bowen, i.e., in latitude 20° S.

on the experiment. Probably the sugar plantations in Northern Queensland offer the most striking attempts, and it speaks well for the future that it is possible to carry on farming operations with white labour, even with such artificial adjuncts as bonuses and unprecedented labour conditions.

As I have written elsewhere, "It has been pointed out that white adults can live in almost any part of the tropics in a healthy condition—and this is certainly the case in the Territory—provided that certain necessary precautions in housing, diet and hygiene are obeyed. It is precisely this necessity for special care and increased exercise of common sense which is found so irksome by the average newcomer to a tropical region. Especially is this the case in the wet period, when a large measure of energy is required to overcome a natural lassitude." The well-housed wife of a senior official with efficient coloured servants, is in a very different position from the poor immigrant woman ; but it is the feelings of the latter which will largely control future close white agricultural settlement along the northern coasts.

How the struggling white farmer's wife is to rear her babes, handicapped by a tropical climate, and probably only assisted by ignorant black gins, is a problem of which no solution is at present obvious. It is a vicious circle. The white immigrant will not go there because the dis bilities—largely due to the sparse population—are so great ; and the population is, obviously, so sparse because there are so few immigrants.

If, however, Australia is left alone until conditions of life becom much more strenuous in the favoured southern areas, then the increased economic pressure will produce the needed influx of immigrants already partly acclimatised to warm climate conditions. But a long lapse of time is indicated, especially as Australia is now notorious as an example of the growth of cities at the expense of the rural population.

A glance at the humidity charts (Fig. 12) will show that there is a great difference between conditions of life in the north coastlands from Derby to Cairns, and those in the East from Cairns to Rockhampton. Hence, although we know that sugar cane (for instance) is a feasible crop for white labour along the latter coasts, it would be rash to assume that agriculture is, therefore, certain to succeed under white labour along our other more tropical coasts.

Professor Gregory, who, as a firm upholder of the White Australia policy, will not be accused of magnifying our disabilities,

writes as follows:—"According to Dr. Haldane, if the wet bulb thermometer exceeds a certain point (about 78° F.) continuous hard work becomes impracticable."

Let us see how conditions in Darwin compare with this ruling. I give in the following table the records of the wet bulb thermometer for the first three months of this year:—

DARWIN WET BULBS AT 8.30 A.M. (1917).

Date.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
January	78	77	78	78	72	77	77	78	80	..	..	74	77	75	77
February	75	76	74	76	76	76	76	75	77	77	71	78	78	78	75
March	77	75	74	75	75	76	78	75	78	78	79	76	78	79	76

Date	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January	75	80	78	78	77	80	78	81	76	75	76	74	79	78	77	73
February	73	75	74	71	77	76	77	75	78	73	75	73	73	..	..	..
March	78	77	78	79	78	79	80	77	74	76	77	77	74	79	79	79

Hence, out of 88 days in these three months, no less than **32** have wet bulbs of 78° or over, while **74** (or **84** per cent.) reach a wet bulb of 75° F. Seeing that only twice in three months did it fall below the value of **73°** F. (which Lamb and others have accepted as the limit of comfort), the prospects of economic white farming along the northern coasts during all the summer months do not seem at all promising.

CONCLUSIONS.

We have now considered, in as great detail as space permits, the potentialities of tropical Australia. Speaking generally, it is a pastoral land, almost the whole of which can be used in normal seasons for the rearing of stock.

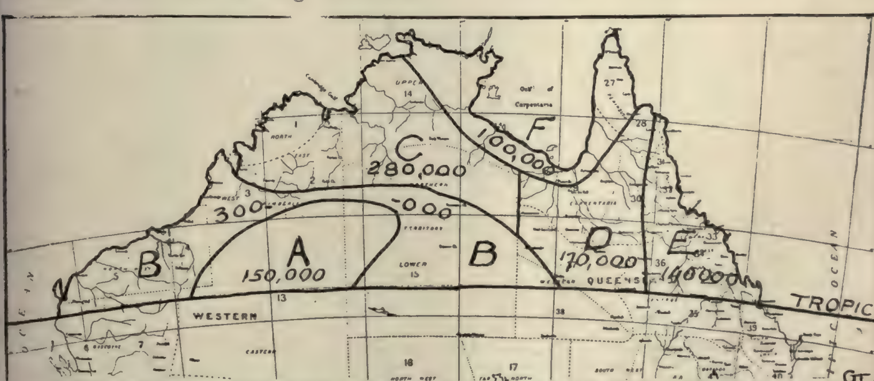


FIG. 28.—Major Economic Provinces in Tropical Australia. The boundaries are only approximate. Figures = sq. miles.

Only in the inland portion of West Australia is there an area (of about 150,000 square miles) which seems to defy permanent occupation—even when the sub-artesian waters shall have been properly utilised.

So far as future settlement is concerned, we may classify tropical Australia in six divisions, of which four are pastoral, and two agricultural. They may be tabulated as follows. (See Fig. 28) :—

	Class.	Approximate Limits.	Approx. Area.
A	Desert Area	Between Tropic & Sturt's Creek	150,000 sq. m.
B	Arid Pastoral Land	Carnarvon, Broome and Boulia (excluding A.)	300,000 ,,
C	Good Pastoral Land	Broome, Darwin and Camooweal	280,000 ,,
D	First-class Pastoral land	Camooweal to Barcaldine	170,000 ,,
E	Eastern Farming Area	East of 145° Longitude	146,000 ,,
F	North Coast Lowlands	Victoria R. to Cooktown	114,000 ,,

Let us now consider these areas in greater detail.

An American writer, comparing the resources of the continents, concludes with the remark . . . . "while by far the greater part of Australia can support no population at all."* This is, of course, absurd as regards most of Australia, but, unfortunately, does seem to be true as regards class A in the above table.

Much of class B can only be lightly stocked, and is liable to periods of prolonged drought, so that the human settlement depending on the pastoral industry in the south-west inland portion of the tropics does not offer much hope of becoming ought but negligible. It resembles the grazing country of Arizona, Southern Sahara and Rajputana. In spite of much larger populations in the vicinity none of these arid regions have been able to support more than a sporadic settlement.

With our White Australia policy, we cannot profitably use the denser populations of Western Rajputana for comparison—and the same remark applies to Southern Sahara.

We may, however, look to a time when the more favourable areas of Australia begin to reach the density of similar regions in U.S.A. In such circumstances, the arid lands of the tropics may reach the density of those in Arizona ; which even now support less than one person per square mile. [As in Arizona, there are valuable mineral deposits in the arid tropics, but mining never leads to close

* Redway, 1902. New Basis of Geography, p. 63.

settlement in the same way as farming. Thus, in all the "non-agricultural" mining fields of Australia, it has been calculated that there are probably only about 120,000 inhabitants.

With regard to class C—good pastoral lands receiving from 15 to 30 inches of summer rainfall, there is no doubt that they will ultimately support a large population U.S.A. offers no suitable homoclime—it is too cool, and lands with similar rain (in Oklahoma, etc.) grow much wheat. Bornu, and other countries in the Soudan, are similar, but their population is largely black. El Chaco, in Northern Argentine (see Fig. 29) is somewhat similar, and supports about one person per two square miles. It contains, however, much

FIG. 29.—Homoclimes of Tropical Australia in Eastern South America. (The Selvas and Andes, etc., are not homoclimes). The ruling indicates the rainfall. Three isotherms are also shown. At the side are Australian ports in the same latitude. (N.B.—Darwin is much hotter than Bahia.)

cereal and forest land, so that the figure is too high for the Australian region if it depends wholly on pastoral returns. I know no other dry, hot lowlands occupied by a European (or half-caste) race. In Rajputana, the density is about 50 per square mile, mostly congregated in the wetter eastern portion. Jeypur, with 20 inches, has 175,000 inhabitants. We may safely assume a density of one white per square mile, when the wetter portions are growing millet, pulses. etc., as it is possible they will in the future.

The country in the east of the pastoral belt (D) rejoices in a more constant rainfall, as shown in Fig. 9. Much the same regions will serve as homoclimes as for class C. We may reasonably expect two or three persons to the square mile.

As regards the agricultural and neighbouring districts in Eastern Queensland (class E), their nearest homoclime (as described) is the east coast of India (see Fig. 20). This is largely peopled by Dravidians, whom some authorities classify as a black race. We shall do better to investigate the conditions in Eastern Brazil—where there is a region with rainfall of similar amount and character (along the Bahia coast) in latitude 10° S. (see Fig. 29).

The inhabitants are largely Indian (*i.e.*, Mongolic), negro and South European, with various half-castes, and total about two millions, or about 12 per square mile. Recent immigrants to Brazil total about 3 millions, about equally divided between Spaniards, Italians and Germans. The Germans have settled in the temperate regions of Rio Grande do Sul, which is a homoclime of Brisbane. The Italians colonise Sao Paulo on the tropic, and the Spaniards have spread through neighbouring provinces. Few have entered the country which in any way resembles our northern coastlands, so that the South American experience is not hopeful for close white settlement north of latitude 15° S. Bahia and Cooktown have about the same average temperature of 76° F., and this line of evidence seems to point to their being the northern limits of important white settlement.

With regard to the narrow northern coastlands (class F), where there is a copious summer rainfall, and a possibility of irrigation, we have seen that many valuable products are grown in the somewhat similar regions of Madras, Bangkok, etc.

But I am unable to find any region of such uniform heat and low elevation which is settled by white farmers—and I feel that the prospects of this being done in Australia are very slight.* Two factors alone suffice to render such close settlement improbable.

* The Official Report for the Territory for 1917, states that there are only ten agricultural settlers on the land.

These are the large areas of cooler country which will long await settlement; and the enviable conditions attending manual labour in the rest of Australia.

It is unnecessary to discuss the effect on these lands, of more frequent communication (whether by rail or sea), or of possible markets in the south or east, or of fostering bonuses, or even of mechanical cultivation. None of these, in my opinion, can over-rule the fundamental law controlling settlement—that no one will occupy distant and unfamiliar regions who can gain a satisfactory living under more attractive circumstances.

Hence, we may conclude that *close* white settlement is impossible under present conditions. I can, therefore, give no estimate of the future population of this type of country. (Class F).

Other possibilities—not contravening the White Australia policy—are outlined in a previous section.

FUTURE SETTLEMENT.—A logical conclusion to the presentation of the resources of the tropics given in this paper, is to plot the assets in the various regions, so as to obtain a sort of contour map, in which the various contours* (or *isoiketes*) represent degrees of "habitability." It is believed that the map constructed to this end will be of value even though it depends largely on the "personal equation" of the investigator.

In the first place, we have to determine the *factors controlling settlement*, their order of importance, and the "weights" to be assigned to them. The following ten factors will be admitted as important by everyone.

		Tentative Weights.
A	Temperature (including elevation)	15%
	Rainfall (including humidity)	15%
B	Metals	10%
	Coal	10%
	Agriculture	15%
	Pasturage	5%
	Timber	10%
C	Communications (steamer, rail, etc.)	5%
	Present Population	5%
D	Health	10%

Now we have to answer in regard to each of the 25 regions defined earlier in this paper.

* A new term is needed in economic geography to express such *lines of equal habitability*. I suggest *Isoikete* from *Oiketos*, habitable.

"How important is temperature (*or* rainfall, or metals, etc., etc.) in controlling settlement ?"

It is to be noted that we are not asking, "What is the *chief* control in each region ?" Hence we must be prepared to give pastoral potentialities a very small place, even though they are the most promising features of our tropics. Thus, the farms of the Herberton district, or the coal of the Clermont district, must lead to a much larger population than the grazing of the Victoria River, valuable though it may be ; and the former are to be weighted accordingly

Temperature and rainfall are the fundamental controls, and so must be mentioned separately, although their control is also indirectly included in the factors agriculture, timber, etc.

Criticism can be levelled at everyone of these weights ; but I fancy that any common-sense scheme of weighting will lead to much the same arrangement of isoiketes as are shown in Fig. 30.

TENTATIVE SCALE OF SETTLEMENT FACTORS.

		See Map Fig. 2	Temp 15	Rain 15	Metls. 10	Coal 10	Agr. 15	Past. 5	Timb. 10	Rail. 5	Pop. 5	H'l th 10	TOTAL
COASTLANDS—													
W.A.	West coast ..	a	7	7	7	0	2	2	1	2	1	3	32
	North coast ..	b	5	10	0	2	2	2	3	2	1	3	30
N.T.	West coast ..	c	5	8	7*	2	4	2	3	2	1	3	37
	North coast ..	d	5	8	1	0	4	2	3	1	..	3	27
	Gulf coast ..	e	5	10	0	0	4	2	2	2	..	4	29
Q.	S. of Gulf ..	f	6	10	0	0	3	3	2	2	1	4	31
	E. of Gulf ..	g	6	8	0	0	4	1	2	1	..	3	25
	Townsville ..	h	8	10	7	2	8	3	10	4	3	3	58
	Fitzroy ..	i	9	12	10	3	10	5	9	5	4	6	73
W. PENEPLAIN—													
W.A.	Kimberley ..	j	5	10	6	0	2	3	3	2	..	4	35
	Sandridge ..	k	8	6	2	0	0	1	1	1	..	3	22
	Pilbarra ..	l	6	6	7	0	0	2	2	2	1	4	30
N.T.	Tanami ..	m	7	6	5	0	0	1	1	..	..	3	23
	Macdonnells	n	9	7	5	0	2	3	1	1	..	4	32
UPLANDS—													
N.T.	Victoria R. ..	o	7	10	4	0	4	5	2	1	..	4	37
	Arnhem ..	p	7	9	3	0	2	2	2	1	..	3	29
	Central ..	q	8	9	2	2	3	2	2	2	..	5	35
	Frew ..	r	9	8	4	0	0	3	2	1	..	6	33
	Barkly ..	s	9	9	0	0	4	5	2	1	..	5	35
Q.	Boulia ..	t	9	7	0	0	0	4	1	2	..	5	28
	Selwyn ..	u	8	8	6	0	2	5	3	3	2	6	43
	Winton ..	v	9	9	2	0	2	5	5	3	2	7	44
E. HIGHLANDS.—													
Q.	Peninsula ..	w	7	10	6	2	4	3	5	3	1	4	45
	Atherton ..	x	12	15	10	4	12	5	8	4	3	9	82
	Hughenden ..	y	10	12	4	4	4	5	8	4	3	8	62
	Peak Ra. ..	z	11	13	7	8	10	5	8	5	2	8	77

* Including most of Pine Creek mines.

In the above table, some one region can usually be found to have been marked with the maximum for any given factor. Thus, Atherton comes nearest ideal circumstances in many of the factors, such as rainfall, temperature, agriculture and health. The Peak Range region contains good coal, which is indicated, and the Townsville division contains valuable softwood forests. Health is judged from the climographs and from prevalence of disease, etc. Places having good railway communication are ahead of those served by steamers and the latter are better than the inland localities, such as Tanami with no regular traffic.

The totals given in the final column are plotted on the regions shown in Fig. 2, and lines (isoiketes) are drawn through those regions exhibiting equal values. We thus obtain Fig. 30, which presents several interesting features.

There is a centre of great potentiality along the Eastern Queensland highlands, and a centre of low potentiality in West Australia. Another low area seems to surround the Gulf of Carpentaria A tongue of favourable country extends from Queensland across to the Kimberleys, which certainly indicates that the railway should traverse the Barkly region rather than the centre of the continent. The isoiketes are very crowded in the Peninsula—showing a rapid deterioration in values as we proceed from Herberton to the Gulf.

Ultimate Population.—It is almost impossible to give concrete figures to these areas. We may assume that the black region will ultimately support from four to eight people to the square mile, on the analogies already considered. We may be sure that the dotted area will never reach one per square mile under present methods of world settlement, for no similar region anywhere has an important population.

Although the absolute values are doubtful, I think we may assume that the values shown by the isoiketes are substantially in the right order. Indeed, we may hazard absolute values. Thus, if the isopleth 80 (in Fig. 30) be taken to represent about 8 per square mile, and the isopleth 35 to represent about one per square mile, for reasons already given, we get the following empirical values :—

Lines of Habitability.	Approx. : Density.	Approx. : Area.	Estimated Future Population.
80 % Isoikete	About 8 per sq. m.	12,000 sq. m.	100,000
70 % ,,	,, 6 ,,	90,000 ,,	500,000
50 % ,,	,, 3 ,,	90,000 ,,	250,000
40 % ,,	,, 2 ,,	150,000 ,,	300,000
35 % ,,	,, 1 ,,	250,000 ,,	250,000
			1,400,000

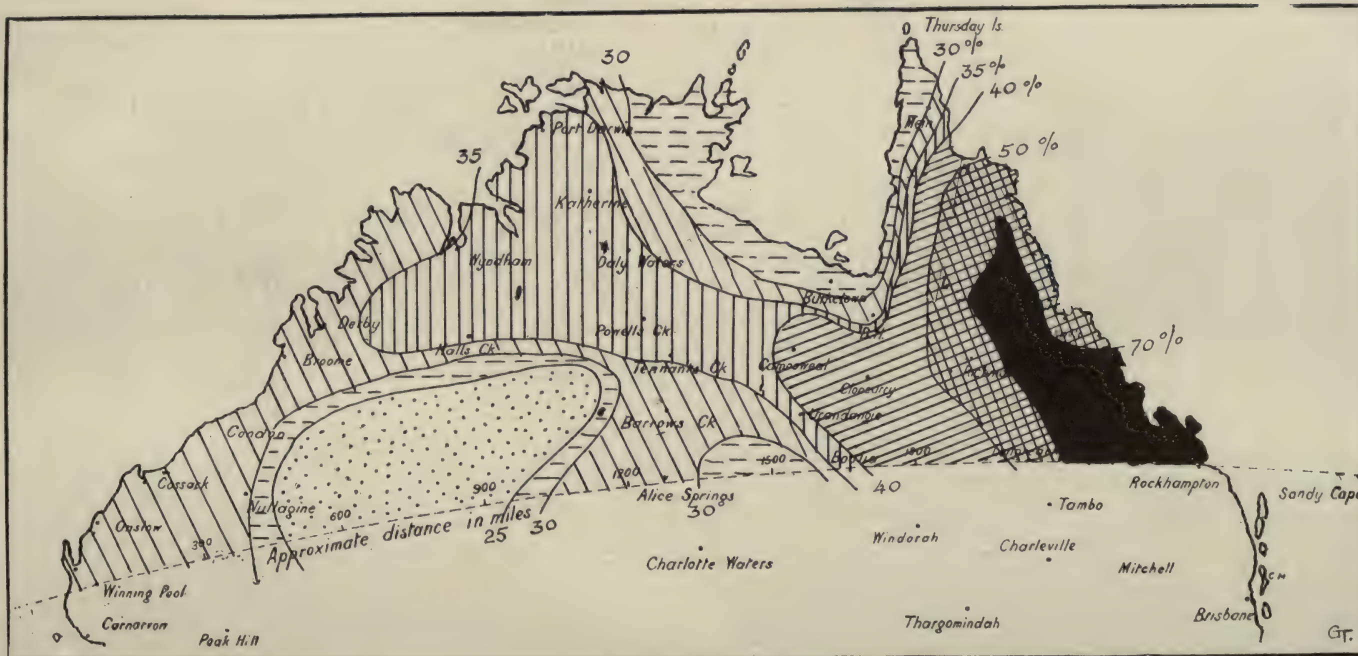


FIG. 30.—Potentialities of Moderate Settlement in Tropical Australia. The maximum (black) represents perhaps six people per square mile. The minimum (dotted) has no possibilities of moderate settlement. (The figures are percentages, where the maximum (100) represents an area with all the advantages described in the text. The distribution lines have been termed *isoiketes.*)

This figure of 1,400,000 people refers to a future period when the whole of the good pastoral country of the tropics shall be far more closely settled than is, for instance, Central Queensland at present. (See Fig. 31). It is no Utopian forecast, but calls for much more advanced cultivation and grazing methods than have hitherto been necessary to secure satisfactory returns. Probably a century or more will pass before this condition is arrived at.

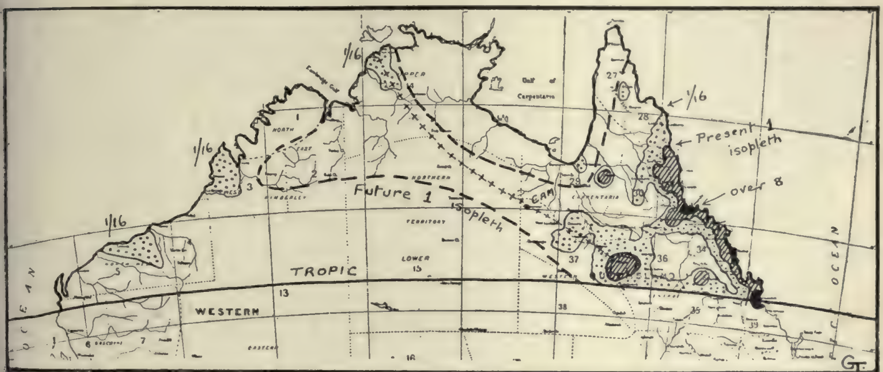


FIG. 31.—Present Population (based on Knibbs). Dotted areas have over 1/16 person per sq. mile. Ruled areas over 1 person per sq. mile. Black areas over 8 persons per sq. mile. Ultimately it is suggested that the one-person area will increase to the broken line. (The natural land route to Darwin shown by crosses).

To ensure these results, one cannot suggest any "royal road." The eastern portion (east of 145° long.) would seem to be progressing steadily through private enterprise. But in the western and central portions, the improvement (in part by public moneys) of transport facilities, by permanent waters—by stock routes, by light railways, and, in fact, by every method that will convert these regions into *fully developed* pastoral holdings cannot be too strongly insisted on. To an impartial observer, the needs of mining men, and the doubtful problems of tropical white agriculture, should be left to a later date—if the Commonwealth's aim be to establish settlement, rather than to grow rich speedily.

My thanks are due to Dr. Gilruth (Administrator of Northern Territory), and especially to Mr. Atlee Hunt (Secretary for Home and Territories), who read through the thesis. On the advice of Mr Hunt, I recast the later portion of the essay, and I owe much to the exceptional knowledge which they possess of our tropical lands.

The climatic aspect of the work is based almost wholly on the three recent Bulletins which I have prepared at the Commonwealth Weather Bureau.

ANNIVERSARY ADDRESS TO THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND

By His Excellency Major Sir Hamilton J. Goold-Adams, G.C.M.G., C.B., F.R.G.S., Etc. (President).

The work of the Society during the Session just closed has been well sustained, and may reasonably be considered as being exceptionally interesting and important.

There has been abundant material in the shape of papers and lectures, embracing a wide range and variety of subjects, and it is satisfactory to relate that, for the first time in the history of the Society, we have been placed in the happy position of being called upon to make an award of our Foundation Gold Medal ; such award being for an elaborate essay on a subject of great public importance, dealing as it does with the settlement of the vast tropical areas of Australia. Other subjects have been announced for competition in future awards of the Medal, and it is hoped that, by the end of the ensuing Session the Scoiety may again be called upon to reward some successful competitor.

It will be remembered that this medal was originally designed to further the cause of Australian Geography in its widest sense. My Council hope that, through the medium of this annual award—the highest in its gift—effective means will be afforded of, not only stimulating public interest in the cause of geographical knowledge, but also of rendering some help, at the present or in the future, to Australia as a whole.

With a desire to associate our members and their friends in every possible way with the active life which ought to exist in such a Society as our own, a circular letter was sent out at the commencement of the year to all of our supporters. This invited communications on such local subjects as might fairly be considered to come within the very wide and comprehensive scope of the Society's operations. It was considered that much might be accomplished in the field of investigation, both along our own Queensland coast, and in many inland parts of the State, which offers many tempting inducements to those who are prepared to undertake hard but interesting work.

There is the Great Barrier Reef with its unlimited storehouse, comprising the submarine fauna and flora ; the geology, physiography, and other geographical conditions, of that vast submerged region ; the numerous islands and channels of our immense seaboard, whose physical structure awaits ample elucidation at the hands of enterprising

* Royal Geographical Society of Australasia, Queensland, August 24th, 1917.

and intelligent investigators. And even at the gateway of our metropolitan city a field for research invites attention in the numerous shifting or changing sand banks that are liable to impede the free navigation of Moreton Bay and the banks of the Brisbane River, at all times exposed to the influence of erosive action. These are subjects of something more than mere local interest, bearing as they do in no unimportant manner on the development of our commercial and industrial life, as well as on the maritime progress of the Port of Brisbane. That this has not been overlooked by the Geographical Society is shown by one of my predecessors in office, the late Sir Hugh Nelson, who in an anniversary address, gave a very full account of the discovery and first survey of the Brisbane River, with maps showing the changes in delineation.

The Report of my Council shows a substantial increase of new Members during the financial year, which more than compensates for the losses sustained by death and other causes. There is, however, no limit to our membership roll, and we shall always be glad to welcome such supporters as may feel disposed to strengthen the good cause to which we are devoted.

At the special request of the members of your Council I now purpose giving you a brief outline of my recent tour in Northern Queensland, and drawing your attention to some of the most interesting incidents which occurred, and matters which were observed, during the course of my journey.

As a temporary sojourner in your midst, I feel very diffident in coming before you and addressing you about your own country, especially as many of my opinions are based upon a very cursory examination made during a hurried tour, and I am well aware how liable a traveller is, under those circumstances, to arrive at incorrect conclusions. This has been explained to your Council, yet the members have been kind enough to ask me to proceed, and, therefore, I trust that, under the circumstances, you and others will be charitable.

In pursuance of this policy, my wife and I have, during the past two and a half years, done a good deal of travelling here and there. This year we determined to see the North-West, the Gulf of Carpentaria, and Torres Straits.

Public and domestic matters, together with a scarcity of shipping up and down the Queensland coast, necessitated our leaving Brisbane on May 25th, and arranging our tour so as to catch the s.s. "Changsha" at Thursday Island on June 22nd., for our return to Brisbane before the last day of that month.

This time-table foreshadowed a very hurried tour, and you will learn later how much even this had to be accelerated.

Our party consisted of Lady Goold-Adams, myself, Mr. Ryder, Mr. Harris of my staff.

We had a pleasant, though cold, trip up the coast in the s.s. "Bingera," and spent many pleasant hours listening to the adventurous life in the South Seas of Captain Mackay, the ship's captain, as told by himself. It is a great pity that this is not put in narrative form by Captain Mackay for those who have not the privilege of hearing them.

We arrived on a lovely morning, Monday, 28th May, at Townsville, and could not help being immensely impressed as we steamed across the Bay with its beautiful surroundings. It seemed in my mind comparable with that world famous beauty spot the Bay of Naples.

It was two years since I had last been in Townsville, and I was agreeably surprised to observe the great strides made in the interval by the Harbour Board, in the construction of deep-water jetties and reclamation of foreshore for the erection of goods sheds.

We left Townsville the same evening, and reached Hughenden, a distance of 236 miles, early next morning. We were duly welcomed by the Mayor and citizens, and visited the different points of interest. The town is pleasantly situated on the left bank of the Flinders River, and consists principally of the usual wood and iron buildings. It gives one the impression of general prosperity, and its streets are well kept. After luncheon, in order to afford us an opportunity of inspecting the neighbouring country, we motored out a distance of 23 miles to Redcliffe Station, of which Mr. Reed is the manager. The country through which we passed was of park-like character, light forest country, with alternating open downs, generally undulating with no prominiently marked natural features ; the soil was of red and black loam, and given water, should be capable of producing abundantly. I was much impressed with the growth of vegetables of all kinds in the station garden at Redcliffe. Though it was mid-winter, cabbages, cauliflowers, peas, lettuces, tomatoes, onions and potatoes, were growing in luxuriance, and not an appearance of any pests. That same night we proceeded again by train, reaching Cloncurry, 245 miles, about 10 a.m. next morning.

In order to give a Brisbane audience a local comparative distance with those in the North, I may mention that Brisbane to Wallangarra, by rail, is 223 miles ; Townsville to Hughenden 236 miles ; Hughenedn to Cloncurry 245 miles.

During the morning we received a most kindly reception from the Mayor and citizens, and were taken, amongst other things, to see the Great Australia Mine, situated about a mile south of the town. Our party descended into the mine and made a somewhat lengthy inspection of its drives and stopes. The copper lode is of low grade quality, but of great use as a flux in the smelters at Selwyn, to which it is taken. This mine was, I believe, the original cause of the coming into being of the Cloncurry township, but owing to a falling off in the percentage of copper, as the deeper mining took place, it was found unpayable to send to the coast for smelting, and, therefore, remained unworked for some years ; but with the erection of smelters in the district, the ore as a flux, as well as a copper producer, was found valuable, and a fresh lease of life for it was started. My wife and I took the opportunity of calling at the homes of some of the employees at this mine, and enjoyed our brief talks with some of their wives.

In the afternoon, I opened a new wing in the Cloncurry hospital, and later on inspected a market garden kept by a white man and his wife, and was very much interested in seeing this successful competition in a lucrative business with a person not of European extraction.

On the following day, accompanied by Mr. May, M.L.A., and Mr. McMaster, the Chairman of the Cloncurry Shire, we proceeded 63 miles by rail to Ballara, getting on to the railway, built and owned by the Selwyn Copper Company at McGregor Junction. At Ballara, we changed into a 2ft. tramway, and were carried through some very picturesque country, some four miles to the Wee Macgregor Mine. This mine is owned and worked by the Selwyn Copper Co., and sends its ore to the smelters at Selwyn. We descended the shaft, and made an inspection of the drives and lode. The feature of this mine is promising, and there is every hope of further high grade ore being found, as the drives are extended into the overhanging hill sides. Visits by my wife and I were again paid to some of the wives of the employees.

We retraced our steps that evening and got to Selwyn, 71 miles S. of Cloncurry, about 5 p.m. Here we visited the hospital, school, and the mine, and after a sumptuous repast, we visited the Smelting Works by electric light. The manager, Mr. Corbould, was busy endeavouring to start machinery just erected, and put through the smelters for the first time in three years, a body of ore from the Company's own mines. Alas, one small defect in the width of the axles in the trollies conveying the ore to the smelters dashed his hopes to the ground for that evening. I should mention to the uninitiated that the technical phrase for one smelting process is a

"blow in"—derived, I believe, from the final stage when air is blown through the molten metal, causing fierce flames to issue from the furnaces, accompanied by wild and weird noises making the night hideous. It is believed that, within the next few years, if capital can be obtained, the Selwyn Company will probably erect, in some suitable locality in the Cloncurry district, very much larger smelting works, and so give considerable more employment.

From Kuridala, we, the same day, went through Cloncurry to Mt. Cuthbert, 69 miles north of that town, getting there in the course, of the afternoon. Mr. Powell, the manager, met us at the station. My wife and I paid our customary calls on the married women before it got too dark to do so; and in the evening inspected the underground portions of the Mt. Cuthbert Mine, but had not time to see the Kalkadoon mine or the smelters, though the latter were at full work, and we were warned for a probable "blow in" in the middle of the night.

The following morning we were taken by rail over the new branch railway, built by the Selwyn Company, to the Dobbyn mine. The name is taken, so I believe, from some old horse that died or was lost by its owner. Here, two hired Cloncurry motor cars awaited us to convey our party to Burketown, a distance of about 180 miles. After an inspection of the mine we proceeded on our journey, and left behind us the rich Cloncurry district.

Before proceeding to detail our journey onward, I wish to give, very briefly, the impressions of the Cloncurry district left in my mind. I picture it as an oval-shaped saucer, 140 miles in length by 70 miles in breadth, situated in a wide tableland, the centre generally flat, with the rim consisting of broken hilly country, higher and thicker on the north and west than in other portions. The whole area mineralised, copper generally of a high grade quality largely predominating, the lodes somewhat broken up, where found in the hills, consequently, to some extent, difficult to trace and develop; whereas, in the central flat regions the lodes, such as the Hampden and the Dobbyn, being more clearly defined, are easier to work, and generally have an east and west direction. The central township of Cloncurry, situated within and close to the eastern side about half-way in the total length. The population being divided into three groups—workers of mines; dependents on mining; and pastoralists—the first two largely predominating and influencing the whole—having ever present in their minds the premature failure of many mineralised areas in Australia—hesitate to have any firm belief in the permanency of that with which they are at present associated,

and also being unable to foresee the consequences of the widespread differences as regards labour between employer and employee, an atmosphere of unsettlement is created, leading to a continuance of the rougher modes of life experienced with early pioneering, and acting as a brake upon the prosperity of the people themselves, their children, the industry, and the country.

The country healthy, and with the ordinary precautions necessary in a hot climate, eminently suited for white occupation.

A considerable portion of the central area of good quality for agriculture, and having within a short distance of the surface, ample domestic supplies of good sub-artesian water, there is every reason for believing that a considerable agricultural population could be established comfortably with every chance of making a reasonable living by supplying fresh farm produce, which at present is almost unobtainable locally, to a large permanent mining population when that exists.

To sum up,—a district of very great promise, slowly forging ahead, but which might be advantageously accelerated if it were possible to establish an increase of confidence in the permanency of the mineral and in the honesty of purpose of both the main sections of the community ; the combination of the two assuring that the other necessary requirements for mineral development would in time be forthcoming.

The main mining industry is in the hands of three large companies, viz., the Selwyn, the Hampden, and the Mt. Cuthbert ; each possessing a central smelting works for the treatment of the ores drawn from their respective subsidiary mines. In addition, there are many small mineral propositions worked by syndicates and individual prospectors, known by the name of Gougers, who dispose of their ore to the larger local companies, or to the agents of outside companies for export through Townsville. The ore in these cases is often carried for miles on camel back, or by small carts, or by traction engines over rough and bad roads. It is quite possible that, if capital were provided for development, it would be found that many of these seeming small propositions were actually of very much larger proportions. Some specimens I received went as high as 65 per cent. of copper.

Recently the Government has established an Assay Office in Cloncurry, which enables the " Gouger " to ascertain the commercial value of his ore, and dispose of it accordingly.

Since visiting recently the large coalfields near Clermont, I have been wondering whether it would be possible to convert the surplus

coal in that locality into electricity, and transmit it to centres like Cloncurry, Mount Morgan and Charters Towers, for smelting processes.

The visits of my wife and myself to many of the dwellings at the different mining centres was most interesting and informative. As in no case was any previous warning of our purpose given, we found the families totally unprepared. Everywhere we met with the most kindly reception. I have to confess that with the exception of our visit at Kuridala, we were sorry to see the accommodation which the women and children had to live in. In some cases small and miserable wood and iron huts were hired from house speculators at rentals of from 7s. to 15s. a week ; in others the dwellings were but of single fly canvas on rough posts, erected by the owners. Sanitation was well looked after. There was very little sickness to speak of. It was truly wonderful to hear from the different housekeepers of the weekly expenditure for the families. The cheery little Scotchwoman came out best ; not only was she able to amply provide for the wants of her husband, herself and her children, but also to put bye in the bank the larger proportion of her husband's earnings.

Want of confidence on the part of the mining companies as to the future demands of labour causes them to hang back in the erection for leasing purposes of dwellings for their employees. A similar want of confidence, owing to lack of information as to the ability and intentions of the mining companies to continue giving employment, causes the employees to hesitate in committing themselves to any large expenditure for housing purposes. The result is that many good experienced miners with families, will not take employment in the district, as it would necessitate the keeping of two homes, and the companies, as well as the industry generally, suffers owing to the urgent need of such valuable help. Those that do take employment, and take with them their families, are never contented, and look forward to the day when they can get away. This question of housing does not, to the same extent, effect the young unmarried man who, generally with little experience of mining, has only himself to think of. Good mining cannot, however, ever be carried on satisfactorily without a considerable leaven of men thoroughly acquainted with the intricacies of drilling and driving.

To return again to where I interrupted my narrative :—

We left the Dobbyn mine at 10.30 a.m., and parted with our Cloncurry friends, first and foremost of whom was Mr. John May, M.L.A., who had kindly chaperoned us throughout. Traversing a fair country road we reached the crossing on the Leichhardt River, 14 miles distant, before noon. Shortly after leaving the Dobbyn we

emerged from what I have styled the Saucer, and got into the flatter and more open Gulf country, extending northward to the shores of the Gulf of Carpentaria. It is not to be understood that minerals are not to be found here, far from such being the case. There is reason to believe that this country also is mineralised, but being less broken up ore bodies are harder to locate. The proximity of the open flat country to the present railway terminus at the Dobbyn affords good facilities for the easy construction of an extension of the railway system northward should such be hereafter decided upon,

Prior to our leaving Brisbane, we endeavoured to gather information as to the road along the Leichhardt River between Cloncurry and Burketown, and what chances there were of getting accommodation on that 200-mile journey. The little information which we obtained was of the vaguest, and it seemed as if the country through which we were about to pass was a terra incognita. Such should not have been the case. At the Leichhardt Crossing, we found a fine timber mill, the property of the Mt. Cuthbert Mining Company, managed by Mr. Moyle. It had been arranged by Mr. Powell, at Mt. Cuthbert, that a pair of horses, out of a wood team, should be at our disposal to pull the motor cars through the sand in the Leichhardt if it was necessary. Late the previous evening, Mr. Moyle found that the team of horses had not arrived as expected, and in order to ensure our having animals next day to pull us through, he set off at 7 p.m., and walked the 14 miles to the Dobbyn, got the team, and returned in time to be of assistance to us. We really did not know how to thank Mr. Moyle for this spontaneous kind-heartedness, but assured him that, in our opinion, there are very few people in this world that would have undertaken, for strangers, such a veritable task. This crossing of the Leichhardt is, I estimate, about 160 miles from the sea, and 400 feet above its level.

The river bed at this point was almost dry, about 350 yards in width, hard and gravelly with accumulated sandy strips, the banks of sandy loam, 30 feet high, and difficult for motor cars, on their own power, to surmount. We lunched at Kamilaroi, 19 miles, the comfortable home of Mr. Doyle, and reached Lorraine homestead, 28 miles further on, during the afternoon. We now had reached the best of what is known as the Gulf country. In general appearance there was not very much difference between this and the ordinary forest land of Central Queensland; but here and there were considerable open flats.

As we proceeded below Lorraine, the grass became ranker and poorer until at the coast it was of a very poor, reedy quality. The

road ran practically parallel with the river, and was more or less the same grade as the bed of the stream, except near Kamilaroi, where the track ran over a low sandstone ridge, which approached the river from the eastward. The soil being of the well-known black character, and it being dry, the track was good, though in places there occurred open sun tracks, which in some cases were above the ordinary width, and called for careful motor driving. During the rains the country is annually inundated for many miles on either side of the river, and wheeled traffic has to cease. Excepting immediately after the rains, cattle have to pasture within reach of the main stream, owing to the outlying shallow lagoons and streams quickly drying up. This serious drawback to the country is being got over by the sinking of artesian bores on most of the stations, consequently, each year sees a considerable increased area being made available for cattle-raising. A great deal still requires doing in this direction, in order to take full advantage of the magnificent grazing which exists everywhere.

I was altogether pleasurably surprised with the general appearance of this country, and am of opinion that it can be reckoned upon, for many years, as a great cattle-raising land. A time may come, however, when Australia requires to produce cotton of her own on a large scale, and in that case I forsee the possibility that this land may be found suitable for that purpose.

It is conjectured that it was on the site of the existing Lorraine homestead that the ill-fated Burke and Wills expedition decided to turn about and strike for home.

On arrival at the house we were informed by the Chinaman cook, Tommy Ah Fat, that his bachelor master, Mr. Kirkaldy, had that morning gone off to a distant cattle mustering camp, and that he would not be back till the next day, when he, the cook, would send for him. We, on the advice of our chauffeur, Jimmy Anderson, who seemed to know the "ropes" of the place, proceeded to take possession of it, and make ourselves at home. A travelling circus, on its way to Normanton, turned up that evening, but not caring to contest our ownership, camped a short distance away. A Mr. Royle, who was superintending boring operations on Lorraine station, 18 miles from the river, also came to the house, and was gladly welcomed. We stayed over next day, hoping to see Mr. Krikaldy, but he did not return, so being forced to leave the following morning, owing to our being due at Burketown that evening, we started, only leaving a written apology for our behaviour.

The 110-mile run was done comfortably, excepting for a distance of about 8 miles, where the road had been cut up a week previously

by a mob of 1,500 bullocks, and had dried like cement. We crossed to the west bank of the Leichhardt without any difficulty about 40 miles from Lorraine, and halted to see the Leichhardt Falls some 10 miles lower down. These falls are occasioned by a broad horizontal layer of sedimentary rock across the stream ; the face of the falls, 35 feet in height, are nearly perpendicular, through the constant breaking away of the rock when undermined by the water. It is said that the river is tidal from here to its mouth, a distance of about 50 miles ; the water which I tasted did not, however, show the presence of salt.

Thirty miles from Burketown we left the Leichhardt and crossed to the Albert, on which river the town is situated.

Floradale, the place of departure at this point, is the point at which the telegraph line from Normanton to Burketown crosses the Leichhardt. An abandoned telegraph station still stands, which until recently had been occupied by a boundary rider of the adjoining station, who supervised the public telephone which was installed there. The telephone has now been removed, and this has caused a great deal of complaining on the part of drovers of stock, and travellers. The very last request made to me on leaving Burketown was "Please get us the telephone again at Floradale."

Burketown was laid out in 1866, and probably in the wrong place. It should, if established at all, have been at what is known as the Ballast Pit, 11 miles from the bar ; whereas it is 26 miles up a tortuous river, shallow in places, with very sharp bends. In one spot, a cutting of 100 yards would save three miles of navigation.

Burketown used to be an important place. When Hughenden was the terminus of the Northern Railway, almost all the trade from Cloncurry, and some distance south, went to Burketown. If any question of right of priority to the Cloncurry trade ever arises, Burketown's claim can scarcely be overlooked. With the advent of the railway into Cloncurry, Burketown commenced to decline, and now largely depends upon the pastoral and mining industries in the extreme north-west of the State. We were hospitably welcomed and entertained by the inhabitants of Burketown. Inspected the historical tree on which it is supposed Landsborough cut the inscription "L1861. Dig 2ft. north" when he was in search of the ill-fated Burke and Wills expedition.

I naturally heard a good deal from the Burketown residents about the necessity of developing the vast mineral and pastoral resources of that part of Northern Queensland, and fully believe that an extension of the railway from the Dobbyn, through the

stations of Alsace, with a branch to Mt. Oxide, Fiery Downs, Gregory Downs, across the Nicholson River, into the Northern Territory, to join the Darwin railway at the Roper River, will sometime or other, be seriously considered. It is somewhat doubtful, however, whether it would be wise to take a Branch to Burketown, as the discovery, some three years ago, by the Harbours and Rivers Department, of a really magnificent harbour between Raynes and Forsyth Island, gives promise of a fine port for the development of all that country. From inquiries I have made, I think there is little doubt that a connection between the above harbour and the mainland could be easily and inexpensively secured, and that the route to be followed by a railway as it approached the coast would be in the neighbourhood of the Cliffedale Creek, where sound ground would be found for its construction.

The harbour selected for the Transcontinental line of Sir Thomas MacIlwraith was near Pt. Parker, 15 miles east of the harbour above referred to.

Many excellent lantern pictures of the natives and country were shown. In conclusion, His Excellency made reference to the difficulties and dangers of navigation from Thursday Island to Cairns, emphasising that the proper lighting of the route should be taken in hand as speedily as possible. A vote of thanks was accorded to His Excellency by acclamation.

EARLY HISTORY OF AUSTRALIA.* (*Abstract*).

By Capt. W. C. Thomson.

An interesting paper was read before the Society by Capt. Thomson on the Early History of Australia, describing its physical features and changes, its development and future capabilities. He said that physical upheavals, depressions, and denudations were the three grand notes in the harmony of nature which sounded the requiem of continents and nations, which have passed away, and which sing the prelude to coming dynasties. All along the east coast of the continent is a physical depression over which the sea now rolls, the islands of the Great Barrier Reef being but the old coastline of the former continent. The coal measures indicated a terrestrial vegetation extending many miles eastward, while the scattered islands along the coast, and to the south, are but skeletons of land which once even connected Tasmania with the mainland. Again, a mountain range extended the whole length of the continent, while a sea divided it from Spencer's Gulf in the south to the Gulf of Carpentaria in the north; the Blue Mountains and the Jenolan Caves giving evidences of the bed of a river there—the whole showing the great volcanic disturbances which have changed the entire physical features of the continent during past ages. These changes included former animal and aboriginal life.

Captain Thomson said that a study of the aborigines, their primitive ways, and the myths and legends we find amongst them, "bring us to the conclusion, after careful analysis, that they form a connecting link with some of the physical changes which have passed over Australia," and that the present aborigines are the remains of a nation, or nations, that have passed away. Their manners, customs, and traditions, all show that they once were in touch with a higher social condition than that in which we find them.

It was well into the eleventh century before a southern continent was heard of from the travels of Marco Polo, though it was said to have been known to the natives of the East many centuries before. "There is every reason to believe that Marco Polo received his information from the Chinese;" but "to the Portuguese may be given the honour of being the first of the Western nations to land on one of the outposts of the Australian continent." Then the Dutch, after taking possession of Java, in 1605, sailed well into the Gulf of Carpentaria, and described the country as a desert, but in

* Read at the Royal Geo. Socy. of Australasia, Q'land., Oct. 20th, 1916.

some places inhabited by "wild, cruel, black savages," by whom some of the crew were murdered. Torres followed later, and in 1616 Captain Hartog, from Holland, landed. In 1622 the ship "Leeuwin" sighted the cape of that name. The first discovery of the south coast was probably Eyre Peninsular, by Nayts; and of the western coast by Carpenter, in 1628, named by him Witts Land, and described as a "foul, barren shore, green fields, and very wild, black barbarous inhabitants." In 1629, Pelsart came in the "Batavia"; and in 1642, Captain Tasman discovered the south end of Van Dieman's Land. A number of minor exploring expeditions followed, including that of Dampier in 1688, before the arrival of Captain Cook when on his famous astronomical voyage. He sighted Australia on the 19th, and landed at Botany Bay in the "Endeavour" on the 28th April, 1770; thence passing and naming Port Jackson, up the Queensland coast, to the Endeavour River (Cooktown), to Cape York, where he and his officers landed and took formal possession of all the land they had coasted; and upon this, said Captain Thomson, "we base our claim to Australia." On Cook's return to England his discoveries were published, and attracted general attention. This was followed up by the despatch of a fleet under Commodore Phillips, in May, 1787, Sydney Cove in Port Jackson, instead of Botany Bay, being eventually selected as the settlement; the French frigates "Boussole" and "Astrolabe," under La Perouse, following only seven days after—"a close run for a continent."

Captain Thomson concluded his interesting paper by suggesting "that we pause, and, with prophetic telescope, look from the primitive condition to the developments of to-day, and, seeing the mistakes that have been made, try to remedy them, remembering that Dame Experience keeps a school, and fools attend it," and dwelt on the need for decentralisation by remedying the crowding into the cities.

PAPUA.

(BRITISH NEW GUINEA.)

THE WONDERLAND OF THE GREAT CENTRAL MOUNTAINS. —PICTURESQUE AND FASCINATING.—WHERE THE PURE PAPUANS ROAM.—ON THE BORDERS OF GERMAN NEW GUINEA.*

By Thos. J. McMahon.

Towards the end of 1915, His Excellency Judge Murray, Governor of Papua, accompanied by his private secretary, a Magistrate, the writer of this article, 120 carriers and orderlies, 70 native constabulary fully armed, set off on foot to explore the great Central mountains of Papua, as far as the borders of German New Guinea. The journey was long and strenuous, and most of it was through country never before trodden by the feet of white men. In these mountains the scenery is wonderful and most uncommon, and the climate as astonishing as it is delightful. Here also are the haunts of the Pure Papuans, a diminutive and little known people. We left Port Moresby, the capital of Papua, in the trim and comfortable Government auxiliary motor launch of 70 tons, the "Elevala," and after a 60 miles journey of much interest, through reef-strewn waters, we arrived at Yule Island, south-west from the port. Next day the party and stores were transhipped to whale boats, manned by stalwart Government native boatmen, clad in comfortable and even elegant ramies of navy blue with red facings. A row of some hours in a broad, shallow river delta, then for a short distance in the river, and next in a deep swift running creek positively alive with alligators, but with banks fringed to the waters edges with lovely flowers, and over-shadowed by magnificent palms, brought the boats to Bioto, a large and populous native village, or rather, a series of small villages surrounded by Alligator-proof fences, made of a stout cane, a creeping plant that grows all over Papua, and is used by the natives for all kinds of binding and fencing. The alligators are so numerous and so bold that it is not infrequent an occurrence for them to break away the fences and sally up the villages and seize children. This is no exaggeration, but so much a fact that the Papuan Government have made it a serious offence with imprisonment, for the fences not to be kept in repair, and the chiefs and village police are held responsible. A chief of a small village had just returned from

* Read at the Royal Geo. Socy., of Australasia, Q'land., March 1st, 1917.

prison, and he had been kept there until his people had fixed up the village fence to the satisfaction of the Magistrate of the district.

The principal chief, attended by a numerous retinue of warriors, more curious than warlike in appearance, came forward to offer a welcome, in the forms of shaking hands and words of greeting, and then hospitality by presenting cocoanuts opened and ready to drink the cool and delicious milk. On a hot day there is nothing more refreshing than cocoanut milk, and the Papuans seem to thoroughly understand this. Near by, a guard of honour awaited His Excellency, made up of our native constabulary, a well set up and fine looking body of men, and who presented arms as the Governor approached. The native constabulary are very carefully chosen, and are sensible, prompt, alert, and drill with precision, the orders being given by native sergeants, old and well-tried Government servants—who are splendid in their bearing and style of command, but lacking the fertility of phrase for which white sergeants are so notable. The details of the expedition were under the experienced control of the Governor's private secretary, Mr. Leonard Murray, assisted by the Magistrate, Mr. Hyndman-Jones, both of whom, as well as the Governor, speaking the native languages fluently, and this is remarkable, inasmuch that nearly every tribe has its own dialect. All being in readiness for the departure of the party, at a signal the police quickly marshalled the carriers in one line, when packs were distributed and particulars taken of the names of the villages from whence they came, and under which they were grouped and known. This was an essential for the easiest and quickest way of passing out the rations in big lots instead of individually. The rations consisted of yams, rice, and many native foods, and which included tobacco. These things were handed out at the end of each day's march, the natives, or "boys," as we used to call them, preparing the food in their own way. They are tremendous eaters, and literally gorge themselves until their stomachs protrude in a most alarming and vulgar fashion. The loads apportioned to them vary from a Thermos bottle to a case of tinned foods. These are carried by two boys, one in front of the other and on a long pole. Once during the march one boy, who was remonstrated with for not taking a fair share of the weight of a heavy box, promptly replied that he had most of the pole to carry, and could not see where the unfairness came in. The carriers were a cheerful crowd, laughing and singing the livelong day, as they swung along at a brisk pace, urged to this by the police, one of whom kept well in advance making the pace. There was one objection we white men had to the carriers, and one

even time did not and could not heal, and that was the smell which their hot bodies gave off, and which at times got so bad that we at the rear made off, too glad to get away from it, if only for a minute or so, it was so horrible.

Smart and all as was the pace made by the police, the credit of leading the party all the time must be given to Judge Murray, who is a champion walker, and a record breaker as is known in Papua. His Excellency, who is a long-legged man, takes immense strides, and in a provokingly easy manner impossible to imitate, and, consequently, he covered the ground in a marvellous fashion. The Governor, in his good nature, did not expect any of us to keep up with him, and it was just as well, for it would have been a case of attempting the impossible. When at times we had something to say to him, while he strode along peacefully and gently, we would be at a sort of dog trot. The moment the interview was over, it was amazing how quickly we dropped back. When, however, he placed his arms akimbo on his hips, the hearts of the party sank, for it was the signal to make a spurt, and those spurts are something to remember, for they were limb-aching performances, even the carriers would let out groans of a despairing tone.

On the seventh day out we reached Mafulu, the furthest inland mission station of Papua and conducted by the Sacred Heart Priests Mafulu, wrapt in mists, is a Government station as well, and a meeting place for patrol officers when passing through the country. The quaint grass thatched roofed buildings of the mission stand upon a very high and long mountain spur, which juts far into, and as it were, overlaps a narrow and deep dark ravine. When the mists are low, it seems to be the one solid spot in the world. The mists of Mafulu are glorious and remarkable, coming and going, folding and unfolding, rising and falling, and changing from white to grey, or sometimes, in the flashing of sunbeams, to brighter colours. At times, when the mists dispel slightly or vanish altogether as they do occasionally for an hour or so, the grand mountain and valley scenery all around comes out in full sharpness and clearness, particularly a great lofty peak immediately opposite and close at hand which has its sides gaped and hollowed by tremendous land slips, many in number; the soil being a vivid bright red. These slips are constantly going on, the earth breaking away and falling to the ravines below with a loud booming noise, not unlike the sound of big guns. Round about the mission, and all the way to the border of German New Guinea, are hundreds of tiny villages. The people at Mafulu, under the good influence of the missionaries, are friendly

and useful, bringing in their children for care and education, but particularly so to be healed of a shocking skin disease very prevalent —or was—in all Papua, and which the missionaries, assisted by the Government, are steadily combating. In our journey, one day, we met a priest in one of the loneliest parts of the mountains, carrying a quite young native child. The poor little mite was simply covered with this foul blemish, its little face almost featureless—one thick mass of warts. The good man had heard from other natives of the child, and had walked, unmolested, 90 miles through the most savage parts of the mountains, and, perhaps, of Papua, to bring the child to the mission station, to be under care and observation. Really one must admit that the heroic men and women, the priests, brothers and nuns of this mission, mostly French, but several English, Irish, Belgians, and even Australians, are doing a noble and successful work, and deserve the highest praise. They take their lives in their hands, and daily go out into the wildest and most dangerous parts of the interior of Papua. The work they are doing is showing the grandest results, and this can be said of all missions, no matter of what church or society they belong. Missionaries truly are the fore-runners of commerce. The world knows nothing, or very little, of what Papua has to offer in variety of scene, climate and prospect. It is a revelation. This territory of the British Empire is not, as is generally supposed, a land stricken with tropical fevers, nor is it a waste fit only for its savage races. There is a grandeur of scene in the great masses of bold, towering, rugged-shaped, far-spreading mountains, green-clad to their very summits ; yes even to the heights of 13,000 feet. And the valleys are as superb as seen from the tops of dizzy precipices, over the dense jungles, through which are streaked great flashing bands of silver, the courses of the mighty rivers and waterways, so numerous in Papua, and which must be eventually one of its greatest assets commercially. In the mornings, when the skies are cloudless, and a glorious sun shines down, this vivid green land really sparkles, the rain drops of the evening before glistening diamond-like from every blade and leaf. And then in the afternoon, the scene is no less beautiful under the sombre hues of rain clouds ; for every afternoon, with precise regularity, down comes the rain, sometimes a heavy shower, but more often a torrential downpour. But the mists are its glory ; like great melting seas of cloud now forming into one fantastic shape, and then quickly into another, drab, grey, and shimmering white, floating in billows upwards to the skies, obscuring the mountain tops, then swiftly falling and spreading out over the black jungles below, thousands of feet below,

like a great white pall, leaving the hills bare, free, and magnificent, in clear-cut contrasts of green and white.

From the moment the first footfall startles the echoes into being, to skip and leap from hill to hill as it were, these echoing sounds carried, one would think, by playful fairies, for they seem unending. Oh, these echoes were wonderful. To that moment when standing on the utmost peaks, the whole time of the journey was filled with intense interest. The far-reaching panorama is impressive and romantic, a new world varied in details and novel in sensation and effect.

A wonderland, one could think, out of which might spring fairies and other ethereal creatures. The mountain sides are walls of moss and fern. Giant tress of immense girth shoot up, the branches thickly festooned with bright flowering creepers, or the sturdy trunks clutched by monster vines with powerful stems and huge leaves, feet long and feet wide. And in and out above the trees and shrubs, darting here, resting there, and fluttering everywhere, are the famous giant butterflies—Papua's speciality. These beautiful many-coloured insects measure 18 to 20 inches from tip to tip of wings, and have bodies the size of a small bird. Out of the mountain sides gush innumerable springs, that softly gurgle as they shape into a tiny stream and ripple along over bright pebbles, and then gaining strength and space, dash away in sudden fury, and rush with mad clash and splash over huge black boulders ,throwing volumes of spray far on high, and tearing down a precipitous way in turbulent abundance, till lost in some deep, swift and silent river. The waterfalls of these mountains of Papua, framed as they are in surroundings new and most gorgeously picturesque, excite intense rapture, and are to be described only in the language of the poets. One day tourists will flock to see them.

There is no exaggeration in making the statement that these mountains are crowded with native villages and native gardens. The villages, very small in size, are dotted over every peak and spur, some, indeed, perched like nests on the highest and most inaccessible spots. The gardens are a jumble of yam vines, sugar cane, bananas, papaws, and several other tropical fruits and vegetables, with here and there a bright croton or graceful palm. They are tilled in a crude fashion, by the women, the men under no pretext being allowed to interfere. and are fenced in with long rope-like cane vines, a lasting and effective protection against marauding animals.

Here, in these mountains, the pure Papuans roam, free and undisturbed, a race quite distinct from the coastal peoples. The

people are almost pigmy in stature, but their limbs are perfect in shape. They are approachable, friendly and hospitable when concilated, but savage and retiring when aggressed, and at the present time are giving the Papuan Government a lot of trouble by the number of murders they are committing among themselves.

The carriers, when nearing a village, gave out loud calls, which reveberated through the hills, and drew the natives from their huts like bees from a hive. Up or down they would rush to meet our calvalcade, the men decked out in rows of shell and dog's teeth necklaces, earrings, and armlets, long nose-sticks, stuck through the lower portion of the nose, and their faces and bodies slashed and dotted with various bright coloured pigments. All, young and old, carried big bows and arrows (long and barb-pointed). The women, scantily clad, are silent and shy, many with blackened faces, a sign of widowhood or family mourning. The women carried heavy loads of yams and bananas as gifts for the party. In return they received handfuls of coarse salt, a luxury to the Papuan. Both men and women always carry small grass hand bags, in which they have toilet requisites, extra jewellery, betel-nut for chewing, and a change of clothing—change being merely a plaited strip of grass, more ornamental than useful, and not at all dressy. The villages, except those near the mission, were in a filthy condition, and certainly one of the first things the Papuans have to learn is to be clean. Pigs and hairless dogs wallowed in the slush beneath the huts, and it was abundantly evident that there are no native inspectors of nuisances. The huts are built high on thin stilts, frail-looking, but strong. Dogs of any kind are not indigenous to Papua, but years ago some were taken over and readily bartered to the people, and now they are to be found even with the wildest tribes, and are always ugly, hairless, scabby mongrels, tenderly cared for, and often suckled by the women.

The wild fruits of this land are very conspicuous in variety, and are as a rule brilliantly coloured. All are, however, uneatable. Some are like large oranges, some like grapes, some like plums and strawberries; but bitter and nasty, yet possessing wonderful medicinal qualities. It is reckoned that there are 179 varieties of bananas in Papua, and certainly there is much truth in the statement, for one can taste in this fruit the flavours of all other fruits. The peach banana tastes exactly like a peach, the fig banana like a fig; the flavours are unmistakeable.

Insect life is practically non-existent, and stinging pests are unknown in these mountains. One little creature exists abundantly and is wonderful in its use. It is called the "six-o'clock" beetle,

and is about the size of a cricket, and derives its name from the well-attested fact that every evening precisely at six o'clock it gives forth, with marvellous power, a great volume of sound, resonant and far-reaching, exactly like an electric gong at a railway station. Without fail, every night, as our watches ticked the hour, or nearabouts, a beetle would start its gong, and in about ten minutes' time the hills would resound with the deafening noise of myriads of these punctual noise-makers. Another little mite, the "Bell Frog," produced the tones of a bell, sweet and startlingly distinct, and all day long the little bell would be heard, both musical and friendly in its tinkle.

Birds and animals of large size were never seen, and few of any kind, beyond Birds of Paradise, some pigeons and wallabies. Birds of Paradise fly high, and are seldom seen, but often heard by their caw, a cry not unlike that of a crow, to which family, with all their brilliancy of plumage, they belong. Snakes are most uncommon. It seems as if nature has reserved these lovely mountains simply for scenic beauties ; but there is in the future a big prospect before them, for it will be found there is a wealth in them that will one day clothe them with gardens of fruit.

Papua is a beautiful island set in a glorious sea, and a veritable garden of tropical and temperate profusion. It has much to offer and much to disclose. Papua one day, in the near future, must become the magnet of a great commerce, and the world's touring field. Perhaps of all the islands of the wide Pacific, there is not one so richly, so charmingly and bountifully endowed as Papua, the land of the picturesque ! Papua is without compare in its medicinal herbs, spices and many other valuable commodities. In Papua, at present, there are hundreds of splendid rubber, cocoanut and sisal hemp plantations. All these are coming into full, and promise of prolific bearing, and what has been accomplished on them, is sufficient proof that money skilfully used in Papua can be safely invested in that territory without fear of failure and loss. It has been said by others, and it can be said now with riper assurance, that Papua is one of the richest dependencies of the British Crown.

The visitor to Papua will be rewarded by a feast of colour such as few other places in the tropics can show. Some of the most gorgeously coloured birds and butterflies, and glorious floral displays, are to be found there. Vegetable growth is luxuriant and rapid, in some parts magically so. The rainfall is generous, and almost any plant will grow. The Government is stamping out disease, so that a town on the coast, like Port Moresby, will soon be as healthy as any in Australia ; while the hill country is entirely free from malaria.

Those who know the mountains are enthusiastic about the climate; the days are warm and bright, the nights cool to very cool. There is undoubtedly a comfortable future for white people in Papua, labour is intelligent and cheap; in short, all conditions are favourable for a big population, and then a tremendous development. Those who would know of the most delightful land of the South should hasten to PAPUA.

INITIATION CEREMONY OF THE BIRDHAWAL TRIBE.

By R. H. Mathews, L.S., Corres. Member Anthrop. Soc., Washington.

The ceremony of initiation described in the following pages, known as the *Dyer-ra-yal*, was in operation among the Birdhawal tribe, whose hunting grounds were situated in the north-east corner of the State of Victoria. The boundaries of their territory are fully set out in my paper on the Birdhawal language now in course of publication elsewhere. In the preparation of the present article, I shall deal only with the most important portions of the ceremony, and my description of even these shall be curtailed as much as possible, in order to keep the paper within moderate limits. It is hoped, however, that the details will be found sufficiently comprehensive for purposes of comparison with similar rites in other parts of Australia.

The Dyerrayal has some interesting points of resemblance to the initiation ceremonies in vogue on the Macleay, Bellinger, Clarence, and some other Northern rivers of New South Wales. For example, the proponents for initiation are taken away from the main encampment in the evening, the mothers and other women being permitted to witness their departure, and even to accompany them up to a certain stage. In my description of the Murrawin ceremony, (1) the men take charge of the novices in the evening, in sight of all the women. Next day the women are permitted to see the boys prior to their departure into the bush. At the Walloonggurra ceremony, (2) the novices are removed from the main camp about dusk, in full view of the women. The men interviewed the women next morning, again before finally going away with the novices.

Another point of resemblance between the Dyerrayal, Murrawin and Walloonggurra ceremonies is that bundles of small sticks or pieces of bark are thrown during the proceedings connected with the separation of the novices from their mothers. In some cases, green twigs are cast over the heads of the women and boys ; in other instances, the women throw bundles of sticks at the men, as in the Murrawin ; in other cases the men throw small pieces of bark over the heads of women, as in the Walloonggurra ceremony.

In contradistinction to the practices just related, of taking charge of the novices in the evening, and allowing the women to be spectators of their departure, there are many tribes in New South Wales and Victoria who take charge of the novices in the early

(1) Queensland Geographical Journal, Vol. 16, p. 37.
(2) Ibid., Vol. 15, pp. 67-68.

morning, and place a covering over the women, to prevent their observing any part of the proceedings. For examples, see my "Bunan Ceremony," (1) "Bora of the Kamilaroi," (2) "Burbung of the Wiradjuri," (3) "Wonggoa Ceremony," (4) and several others.

There are other tribes who, although the boys are removed from the camp in the morning, yet the women are allowed to witness the proceedings. Examples are given in my "Wandarral Ceremony, ("5) "Toara Ceremony of Queensland," (6) "Dolgarrity Ceremony of Victoria," (7) "Nguttan Ceremony," (8) and others.

In regard to the launching of missiles, such as small sticks, pieces of bark, or green leaves, over the heads of the men, women, or boys, it is practised at some period during the course of nearly all the inaugural ceremonies, but in many of them the projectiles are thrown when the graduates are brought back to the main camp, after having been away in the forest with the old men. In some cases the missiles consist of burning sticks or bark taken from the camp fire. Moreover, in a few of the initiation ceremonies, the men fling small sticks at the marked trees while exhibiting them to the novitiates. (9)

The time occupied in connection with the initiation ceremonies of the Birdhawal tribes was kept within the shortest possible limits. When the messengers were sent to gather the neighbouring tribes, the date of the arrival of the contingents at the main camp was so arranged that they would all turn up within a day or two of each other if practicable. When all the participating mobs had arrived, the business of the meeting was promptly proceeded with; and when the novices were taken away from their mothers, the duration of their sojourn in the bush with the elders and the kuringal was no longer than was absolutely required. The necessity for all reasonable expedition is obvious, when we remember that the life of all Australian savages is one continual struggle for existence, and hence the extra demand on the game and vegetable products due to the "invasion," of the visiting tribes is quite a serious and momentous matter.

It will not be out of place to mention here that the remarks in the last paragraph apply to the meetings for initiation purposes in all Australian tribes. In their native state, before they could rely upon

(1) American Anthropologist, 9, p. 336.
(2) Proc. Roy. Soc. Victoria, 9, N.S. p. 154.
(3) Journ. Anthrop. Inst. London, 25, p. 308.
(4) Journ. Roy. Soc. N. S. Wales, 38, p. 310.
(5) Proc. Roy. Soc. Victoria, 10, N.S. p. 32.
(6) American Anthropologist, 2, N.S., p. 142.
(7) Journ. Roy. Soc. N. S. Wales, 38, p. 330.
(8) Proc. Amer. Philos. Soc. Philadelphia 38, p. 69.
(9) Journ. Anthrop. Inst., London, 26, p. 330.

getting supplies from the white people, it was not usual for the aborigines to remain in one camp more than a few days, their stay for a longer time depending upon the productiveness of the locality. As soon as the natural food supply was exhausted, they were compelled to remove to a fresh camping ground. With a large temporary increase in the number of the people, incidental to these ceremonies, the difficulties of obtaining food were correspondingly increased. The various parts of the inaugural rites were, consequently, disposed of as soon as practicable, in order to let the visiting tribes disperse and return to their own hunting grounds.

We will now give a short account of the details of the ceremonies as carried out by the Birdhawal tribe and their congeners.

The mustering of the people to attend the Dyer-ra-yal was accompanied by substantially the same routine as that in vogue among their neighbours. While the messengers were away gathering the different tribes, the men who remained at home selected a suitable place for the meeting, and erected their camp there. Around this camp, as a datum point, the new arrivals took up their quarters, facing the direction from which they had come. As far as the nature of the ground admitted, they occupied exactly the same relative position to each other in the camp as they did when at home in their respective hunting grounds. The locality selected for this general camp was an area of moderately level ground in the proximity of water, and where firewood was easily obtained. It was also chosen in a portion of the tribal hunting grounds, where game and other foods were sufficiently abundant, to afford a supply of food for the people who should be in attendance while the ceremonies lasted. On the arrival of a contingent of men and their families, who had been invited, they approached the main camp, and assembled on a clear space prepared for the purpose, and their head men called out the names of remarkable mountains, waterholes, camping places, and other characteristics of their country, pointing their weapons in that direction. Each contingent would have one or more novices to be initiated.

When all the mobs of visitors who had been expected to join in the ceremony had arrived at the main camping ground, all the head men present assembled at the *wurrudhang*, or private meeting place of the initiated men, and after a consulation among themselves, they determined the day for the commencement of the principal function of the meeting. The guardians, or preceptors, of the novices, and also the band of men who are to have control of the entire pro-

ceedings, are selected at this meeting, or at adjournments of it. This band of men are called collectively *ku-ring-al*, some of them being taken from each of the tribes present.

About the middle of the appointed day, the novices brought by each contingent, were gathered up on a convenient place on the confines of the camp, and the body of each boy was painted in accordance with the custom of the people, and his hair was ornamented with feathers. This work was entrusted to the mothers and sisters of the boys, accompanied by several of the elder women. The young girls, who are the possible wives of the youths, also take part in the painting, and so do some of the men who are appointed guardians, to see that everything is carried out according to ancient usage. The guardian, or sponsor, of a boy at these ceremonies, was called *bul-lu-wrung*. He was one of the brothers, actual or titular, of the women, from among whom the novice could, when old enough, obtain a wife in accordance with the tribal laws. An indispensable qualification for the duty of guardian was that the man must have passed through the inaugural rites of his people.

The afternoon was far advanced before the decoration of the novices was completed. They were then placed, sitting down, in groups, the boys of each contingent sitting together, while their mothers and the elder women droned some chants similar to the *bobbarubwar* (1) songs of the Kamilaroi women at the Bora ceremonies. Late in the afternoon the women and novices were directed to proceed to a spot a short distance out of sight of the camp, accompanied by some of the guardians, to show them where to go. This place, if not naturally clear, was prepared by removing the undergrowth and accumulations of small broken timber from its surface, which was then levelled and made smooth. The novices were placed, sitting down, in the same order as they had been sitting at the camp, with their heads bent forward. They were seated on green boughs or pieces of bark spread on the ground for the purpose. The mother of each youth stuck her yam stick into the ground beside him, to the top of which a bunch of green twigs was tied. The novices were now called *dhur-tu-ngurrin*.

Presently, the men constituting the *kuringal* were seen to approach, in Indian file, at a sort of jog, forming a winding line, having their bodies painted and grotesquely ornamented. Each man had a narrow piece of bark in one hand, with which he struck the ground at intervals of a few paces, uttering grunt-like exclamations The women beat their folded rugs with their open hands, muttering in a low tone. The men came up in front of the boys, about half-a-dozen

(1) "The Bora of the Kamilaroi Tribes," Proc. Roy. Soc. Vic. Vol. 9, N.S. p. 153.

paces from them, and formed into a curved line, the concave side of which was towards the boys and the women. They then crouched down, and one of the outside men hit the ground in front of him with his pece of bark, each of the other men following in succession, terminating at the other end of the line (2). This was repeated backward and forward along the row of men several times, after which all hands returned to their respective camps, the men going by a slightly different way to that taken by the women and novices. The novices belonging to each contingent went with their mothers to their own respective camps.

The following day the men went away some fifteen or twenty chains from the main encampment, and erected a bough yard, (3) approximately in the shape of a horse-shoe, being open at one end, the enclosure varying in size according to the number of novices and guardians to be accommodated. The convex end was generally towards the quarter of the compass from which the wind was blowing. Leaves of such trees as grew in the locality were thickly strewn on the floor, which had previously been made level. Having finished their work, the men all returned to the main camp.

In the afternoon of that day, about an hour before sunset, the women, novices and guardians repaired to the place where the beating of the ground with the bark took place the day before, whither the men of the *kuringal* detachment shortly afterwards followed them, and went through a similar performance. At its conclusion, the men withdrew, leaving the women and their companions there. In a little while the men re-appeared, walking leisurely in a sinuous line, the head man being in the lead. Every man carried in his hands a few small green twigs, from which the leaves had been stripped off, known as *deddelun*. These twigs had been broken or cut from the extremities of growing bushes, and were about eighteen inches long, varying in thickness from that of a goose quill to that of a lead pencil. As the men appeared, the novices were raised to their feet, and placed standing in a line, with their faces towards the land of their nativity. The women stood in two or three parallel rows a few yards from them.

When the men came up close, they formed a circle round the novices, and commenced throwing the *deddelun* over their heads. Some of the men brought in extra supply of twigs, which they handed to the mothers, sisters-in-law, and sisters of the novices, The women then took part in casting the twigs into the air over the

(2) "The Bunan Ceremony," American Anthropologist, Vol. IX (1896) p. 338.
(3) "The Wonggoa Ceremony, Journ. Roy. Soc. N. S. Wales, Vol. 38, p. 313.

boys' heads. This performance lasted but a few minutes until all the twigs had been thrown, after which the young women gathered them up off the ground. Each novice was then held up on the shoulders of the men who had charge of him, and while in that position he raised his arms, and gave a heaving or vibratory motion to his chest, by spasmodically drawing his breath in and liberating it again, swaying his body at the same time. Each boy was elevated in succession, and handfuls of leaves were cast at him by all the people present, amid congratulatory shouts. The whole party, male and female, then started away to the semi-circular enclosure above described, the men carrying the novices being in the centre, and the women in the rear, carrying the *deddelun*, which had been gathered off the ground.

On arrival at the bough yard, the *dhurtungurrin* were placed lying down, face upward, on the leafy bed which had been prepared for them, and were covered over with bushy twigs and leaves. (1) One or more fires were lighted not far from their feet to keep them warm. The boys were told that they must not turn over, nor in any way change the position in which they had been laid. They were forbidden to scratch their heads or any part of their bodies. If they wanted to attend to any necessity of nature, they must do it where they were lying. (2) They were not allowed to speak. If a boy wanted anything he must make a sign to the guardian who had charge of him. (3) The same lot of women who had been connected with the ceremonies from the first took up their position at the outside or convex end of the bough fence, and made fires there, at which they sat down to rest themselves.

After a short time, the elder women, accompanied by the others, got up and commenced walking round the enclosure, the men joining in the procession at the rear. The women carried in each hand a few of the twigs which had been cast over the novices, as already stated, which they beat together as a sort of accompaniment to a monotonous chant, which was supposed to act as a lullaby in putting the novices to sleep. The meaning of the song was unintelligible even to the singers themselves. This marching round and round the enclosure, and the beating together of the *deddelun*, was kept up all night. Soon after daylight next morning, the humming sound of a bull-roarer, *turndun*, was heard in the near distance, upon which the women were directed to lay down the twigs in a heap on the ground alongside of the bough fence, and to depart to the main encamp-

(1) "The Murrawin Ceremony," Queensland Geographical Journal, Vol. 16, (1901) p. 37.
(2) "The Walloongurra Ceremony," Ibid,, Vol. 15, (1900) p. 68.
(3) "The Keeparra Ceremony," Journ. Anthrop. Inst., (London, 1897), Vol. 26. pp. 330-331.

ment. One of the men went with them, to see that the injunction was complied with. All the women and children then went away to a fresh camping place, the location of which had been decided by the old men.

When the women got out of sight, the head men and magicians proceeded to remove the leafy covering from the novices, and woke them up. They were all placed in a sitting posture, but still remained silent. Each boy was now dressed in the full regalia of a man of his tribe, comprising a brow-band, waist-girdle, apron, and other articles. A rug or other covering was then cast over each novitiates' head, in such manner that he could not see anything which was going on around him. All this having been satisfactorily completed, the *bullu-wrung*, or guardian, who had been assigned to each novice, assumed the charge of him. A firebrand was now applied to the bough yard, and the whole structure the leafy bed, and the *deddelun* were completely consumed. The whole party then started away to another camp several miles distant, where the boys were placed sitting on leaves spread on the ground, cross-legged, with their heads bowed upon their breasts. Their guardians remained constantly with them, but the novices were neither allowed to converse among themselves nor with their preceptors. If a boy wanted anything, he made a sign to his guardian, who then asked him what it was, and the novice told him in a whisper.

The men of the *kuringal* went out hunting, and returned a short time before sunset, bringing such game and other food as they had obtained. This was cooked, and a limited allowance of the best parts given to the novices. A few days might be spent at this camp, or a fresh camping place might be reached every night, this matter depending upon the food supply. If the party shifted to a different camp every night, the novices were taken out hunting with the men during the day. They marched along with the covering on their heads, in the custody of the *bulluwrungs*, and on arriving at the locality which had been agreed upon as the camping ground for the night, a breakwind of boughs was made for the novitiates if the night was cold, some of the guardians remaining constantly with them.

At these camping places in the bush, different burlesques were performed every night by the light of the camp fires, such as pretending to dig a wombat out of its burrow, frightening opossums out of a tree, (1) and the like, for the instruction and amusement of the catechumens. As the representations were similar in character to others described

(1) Journ. Roy. Soc. N. S. Wales, 38, 319.

by me in the initiation ceremonies of many other Australian tribes, it is not considered necessary to give further details here.

In the afternoon of the last day of the stay in the bush, the boys were placed sitting down, with the covering still upon their heads. A number of the kuringal, who had painted their bodies with powdered charcoal and grease, with grotesque decorations on their bodies and in their hair, now assembled on a clear space, in a curved line, some twenty yards in front of where the neophytes were resting, and commenced swinging the bull-roarer, *turndun*. The guardians helped the boys to their feet, and, removed the covering from their heads, directed them to pay special attention. An old man then approached each novice and rubbed the instrument on his breast, and some other portions of his body, and invited him to take particular notice of it. Each boy was cautioned by a man belonging to a tribe other than his own, that if ever he betrayed anything he had seen or been taught in the bush, he would be killed. From this time onward, the novitiates' heads were left uncovered, and they were free to look around them, and converse if first spoken to by their seniors.

The day being now far advanced, all hands proceeded to the women's camp, which might be a mile or two distant, or perhaps farther, where they were all passed through the customary smoke ordeal. A short time after dark, some of the men and novices went into the bush adjacent to the *burrikin*, or camp of the women, and swung the larger and the smaller bull-roarer. After that everybody retired for the night, the neophytes being conducted to a place prepared for them close to the men's quarters. During the next day all the visiting tribes departed on their homeward journey, each tribe taking with them the graduates belonging to a neighbouring tribe, this matter having been arranged by the old men. During this term of probation, the scarring of the youths' bodies was carried out, and they were further instructed in the songs, dances, and folklore of the people.

It was incumbent upon each neophyte that he should participate in one or more additional inaugural gatherings before he was fully qualified to take his place as a man of the tribe. The reason of this is evident, when we remember that at the first Dyer-ra-yal which a novice attended, he was prevented from seeing the whole of the ceremonial, in consequence of being covered over, and having to keep his eyes cast down during some of the most important parts of it.

In some cases, a boy was not more than twelve or fourteen years of age when he was first initiated, which was another ground for delay in admitting him to the full status of manhood.

During the long course of instruction, which commenced from the time the novices were separated from their mothers until they there finally recognised as men, they were taught what kind of food they might catch and eat, as well as what foods were tabooed to them. The food rules as to the eating of flesh were explained by the old men, but there were certain occasions when the boys were conducted to a place where the women were assembled. The mothers and female relatives of the graduates gave them vegetable food, which conferred upon them the freedom to eat a particular vegetable from that time onward. On another day, the boys were brought up and the women gave them water in a native vessel, after which they could drink water from any stream in the tribal territory. Compare this with my descriptions of the " Keeparra Ceremony," (1) and the " Burbung of the New England Tribes," (2) where the women gave the neophytes a drink of water out of a koolamin.

(1) Journ. Anthrop. Inst., London, 26, pp. 336-337.
(2) Proc. Roy. Soc. Victoria, 9, N.S., pp. 133-134.

GEOLOGICAL AND GEOGRAPHICAL CHANGES IN CENTRAL QUEENSLAND

DURING A LATE PERIOD.

By Arthur Jones, Senr.

The author gives his views in certain geological and geographical changes in Central Queensland during a late period, with special reference to the changes in the probable original courses of the Fitzroy River and its tributaries.

THE NORTHERN TERRITORY.*

By H. I. Jensen, D.Sc.

SUMMARY OF CONTENTS.

(For Illustrations, see maps and figures accompanying N.T. Bulletins).

I.—INTRODUCTION.

This paper is based upon four years' experience as Director of Mines and Chief Government Geologist of the Northern Territory. During my tenancy of those positions, I found it necessary to visit distant parts, and saw practically every type of country existing in the Territory north of the 20th parallel. The Oadnadatta end of the Territory, and the McDonnell Ranges, I have not visited, and will, therefore, not deal with them in these remarks.

Those matters which are dealt with in ordinary geography text books, and in published Commonwealth statistics, I will omit as far as possible in this report, confining myself rather to observations made by myself in the course of my journeys. The long journeys have been made on horseback, with a string of pack-horses, and the assistance of a blackfellow. Where detailed observations were necessary, a halt was made for a few days, and the country was scoured on foot. I have followed the travelling methods usually indulged in by geologists and bushmen, and frequently my path has lain through untrodden country, sometimes floods or other causes necessitating long detours for hundreds of miles, far off any road, track or path.

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* Royal Geographical Society, Australasia, Queensland, June 14th, 1917.

II.—NATURAL FEATURES.

The Northern Territory is not like Papua, an impressive country as viewed from the coast. It is geographically divisible into three zones or belts, each of which has its own characteristic natural features, which will, therefore, be described separately. These belts might be termed—(*a*) the coastal belt ; (*b*) the hill belt ; and (*c*) the inland plains. The actual boundary between any two of these divisions is sometimes very ill defined, as sometimes there is a gradual transition from the one to the other.

(*a*) THE COASTAL BELT.—As one approaches the Northern Territory in an ocean steamer from Southern ports, the first land sighted is the projecting Port Essington, Coburg Peninsula, with Cape Don at the apex. Occasionally, when the vessel passes close to the shore, Tor Rock, a high granite monolith, may be seen on a clear day, far inland. The coastline itself, with the exception of the small elevation of Cape Don, is flat and uninteresting. After rounding Cape Don two conical hills are seen, rising out of the low marshy country fringing Van Diemen's Gult on the north-east. Otherwise the same low-lying monotonous coastline persists almost to Port Darwin.

The low flat coastal country can, on closer observation, be again divided into—(i.) mangrove coast, and (ii.) low cliffs. The former consists of mangrove swamps and salt marshes, gradually rising inland into flat marshy country. The low cliffs, where they occur, seem practically coincident in level with the country behind, though undoubtedly there is a slight rise inland.

The same scenic types may be observed on Bathurst and Melville Islands, which are passed in sailing to Darwin.

Passing from Port Darwin south-westwards, in a coastal boat, much the same type of coastline is seen, until the estuaries of the Fitzmaurice and Victoria Rivers are reached. Here the coastal belt fails, and the hill belt abuts on the shore.

Going in the other direction from Cape Don along the coast to the Gulf of Carpentaria, one sees only flat mangrove and low cliffy coasts, until Cape Wilberforce and the English Company Islands are reached. Here we have a projecting portion of the Arnheim Land plateau abutting on the shore, and the coasts are fringed with high cliffs and steep escarpments, both on the mainland and on the islands. High cliffy coasts now persist southwards along the shores of the Gulf of Carpentaria to Cape Saunders, where the horizontally bedded Arnheim Land sandstones and shales yield place to granites and schists, which rise ruggedly out of the very water's edge. The coast-

line continues to have an interesting diversified appearance as far south as Cape Grey and Blue Mud Bay, but thence southwards the Gulf of Carpentaria coasts are lined with low mangrove, such as one sees at the mouths of the Roper, McArthur, and other rivers. Groote Island is a well diversified island, conforming physiographically to the diversified nature of the mainland opposite to it. The Maria and Pellew Islands, further south, are largely mangrove-fringed, as is the case with the mainland shore opposite to them.

The Territory coastline is predominantly, as may be judged from the above, of a flat uninviting nature, that is to say it is for the most part fringed with a coastal plain. This, of course, indicates, according to the laws of physiographic evolution, recent elevation. The cliff sections seen on the coast at Darwin and elsewhere, at first cast a doubt on this conclusion, as a rugged coastline is generally taken to signify recent subsidence. However, on closer examination, the flat cliffs are everywhere seen to be due to recent marine erosion in horizontally bedded tertiary laterites and porcellations overlying weathered metamorphic rocks. The soft decayed metamorphics outcrop near the tidal level, and permit of wave action undermining the harder chemically-formed strata, laterites and porcellanites. Further, in support of the theory of geologically recent elevation, we have at numerous points, both on the flat mangrove beaches and in the embayments of the cliffs, accumulations of raised beach material of a recent nature, consisting principally of shell material.

The rugged coast at Cape Wilberforce and the English Company's Islands is due to faulting and subsidences of the nature of trough faults.

The coastal belt is usually from 40 to 100 miles in width.

The larger rivers enter the sea by wide mouths, but are, with the exception of the Adelaide River, obstructed by bars and shallows at the mouth. The Roper River is navigable for a greater distance than any other Territory river. The Mary River has no mouth at all. It empties itself into a large mangrove swamp, which, no doubt, is drained by innumerable little channels.

The tides rise very high on the western coast of the Territory. At Darwin the difference in level between high and low water at spring tides is about 28 feet. On the northern or Arafura coastline the rise is about 15 feet, but on the Gulf of Carpentaria the rise and fall of the tide is very slight. On the McArthur River the range is about 3 feet, and still less in the Pellew Islands. Moreover, the tides come irregularly in the Gulf, sometimes only one in 24 hours, sometimes three in 48 hours, and so forth, depending largely upon wind and weather conditions.

(*b*) Hill Country.—Behind the coastal plain lies the hill belt. As one travels inland from the shore line the country rises almost imperceptably, and in most places the coastal belt merges into the hill belt without any characteristic border zone. The laterites which, near the coast, spread over enormous areas of country, to a great extent cut out as one gets inland, exposing the underlying metamorphic rocks. Where laterities or porcellanites occur inland we generally find them capping ridges and hill tops.

About fifty or sixty miles from the coast in the Darwin sector of the Territory, the average elevation of the country is only about 400 feet above sea level, while the higher hills only attain an altitude of 750 to 800 feet. The highest mountain in this portion of the Territory, Mt. Wells, near Burrundi, reaches a height of 900 feet. Although the ranges and hills are not high, they become exceedingly rugged as one enters the region where the rivers and their tributaries rise. The scenery near the heads of the Margaret, McKinley, Adelaide, Douglas, Daly (Flora) and Katherine Rivers is of a pigmy alpine nature. The main streams flow through broad alluviated flats, but the tributaries and head waters rise in wild stony ranges and hill groups, or very often in flat laterite-capped tablelands of an altitude of 800 feet above sea level. The tablelands in which the Mary River rises form a magnificent amphitheatre of pink and white cliffs, which, once seen, will never be forgotten, as it is a sight of particular beauty.

The hills have very little soil covering. The naked rocks outcrop on the steep slopes. This is the result of the rapid rush of the torrential summer rains, which wash down all the rock waste formed in the dry season. Owing to the paucity of soil the hills form the mining country of the Territory. The reefs and lodes are easily noticed, and are very abundant.

The fall of the rivers between the hill belt and the sea being slight, owing to the small elevation of the hill belt, the run off in flood time is slow. Hence the rivers overflow their banks, and spread over the wide flats, which are in this way alluviated with the waste from the hills.

(*c*) Inland Plains.—There is seldom any marked fall of country between the hill belt and the inland plains, yet the definition between these two zones is sharper than between the hill country and coast country. The inland plains range from 700 feet to 1,400 feet in elevation, hence in average elevation they are higher than most of the hill country, excepting the Arnheim Land Tableland. They owe their well-defined characteristics more to their geological composition rather than to other factors, since they consist principally of limestone

and quartzite of Cambrian age. These formations, being not nearly so folded and crumbled as the Pre-Cambrian metamorphic rocks of the hill belt, and being of a much more uniform composition over large areas, have not been greatly dissected by erosion.

The inland plains rise gently from the Katherine Telegraph Station and Maranboy tin field (about 700 feet), as one travels south towards Newcastle Waters and Barrow's Creek (about 1,000 feet). Proceeding from Wave Hill, near the head of the Victoria River, in a southward direction, to the Tanami gold field, one rises from about 700 feet at Wave Hill to about 1,000 feet on the divide between the Victoria River and the eastward flowing Hooker's Creek, which flows into an inland depression lying to the west of Barrow's Creek. It was in this depression that Dr. Chewing obtained good water supplies in very shallow wells on his exploring expedition. From Hooker's Creek, the elevation rises gradually to 1,400 feet at Tanami, where, as is usual in the more elevated inland areas, the old auriferous rocks outcrop through the denudation of later deposits.

Between Wave Hill and the overland telegraph line, lies an enormous treeless plain of limestone, described by explorers and surveyors as "black soil plain without stones or surface water." It is decked with magnificent Mitchell and Flinders grass, and will become of great value with the advent of sub-artesian boring.

The inland plains are divided by the stockmen into country of two types, namely, "plain" and "desert." The "plain" is either quite destitute of timber or sparingly timbered. On the Barkly Tablelands, one can travel 50 to 100 miles in one direction without seeing a tree. When limestone plains carry timber, it is usually composed of scattered bauhineas, with interspersed mimosas. Occasionally, the silver-leaved box, or in swampy places the gutta-percha put in appearance. The McArthur station plain, the Wave Hill plains, the Elsey plains, and others, are thus timbered. The Barkly tableland black soil plain is, however, more often destitute of timber. It is covered with luxuriant Mitchell and Flinders grass, blue grass, and blue bush; at intervals a straggling whitewood bush (*alrtonia rp.*) may be seen magnified by the ever-present mirage, so that often a little bush 3 feet high appears to the weary traveller a high shady tree, towards which he steers, in the vain hope of getting a few minutes' respite from the blazing sun. In this country, dry stages ranging from 60 to 100 miles are common, surface waters being few and far between. In the Victoria River country, on Wave Hill Station and on Nutwood Downs Station, there are large areas of intermediate and basic volcanic rocks, ranging from trachyte and

phonolite to basalt. This formation also yields black soil plains, but they are bestrewn with pebbles and boulders of volcanic rock, fragments of rock crystal and amethyst, and are sparingly forested with nutwood, mimosa and more rarely a sprinkling of bauhinia.

The only stones found on the typical limestone plains are banded flint pebbles, locally known as ribbon stone, which is often very ornamental in appearance.

The so-called "desert" country is timbered country, and contains most of the permanent water-holes. Geologically it consists of quartzite formation. It has a poor, hungry, sandy soil, and produces no grass, except tussocky spinifex. However, numerous species of wattle and acacia growing in this kind of country are eaten by stock when droughty conditions drive them to the permanent waters. The eucalypts of the "desert" are mostly of a stunted mallee kind.

The only saltbush country I have seen in the northern portion of the Territory is in a porphyry area on Helena Creek, a branch of Winnecke Creek on the pad to Tanami.

III.—GEOLOGY.

(*a*) PHYSIOGRAPHIC OR PETROGRAPHIC.—The northern or peninsular part of the Territory, lying west of he Gulf of Carpentaria, constitutes a raised peneplain of cretacea-tertiary or early tertiary age. This is proved by the position of the porcellanites and laterites, which are almost coincident in level with the sea along the coastline, but are elevated to a height of 700 feet or more about 100 miles inland. The elevation has been of an isostatic and differential character, and has produced an arching of the lateritic sheet. The age of the peneplain is evidenced by the occurrence, in isolated places, of late cretaceous or cretacea-tertiary fossils, such as belemnitic remains in the Port Darwin porcellanites, and occasional ammonitic casts at Point Charles and other places on the coast. The width of the river valleys and the residual character of the hills inland are also points indicative of a long period having passed since the elevation of the peneplain commenced.

The laterites and porcellanites were deposited under arid erosion conditions. They are undergoing weathering and disintegration to-day, except in a few little gullies in the hill belt where I have observed lateritic deposits in the course of formation.

Coastal Belt.—The coastal belt is very largely covered with a sheet of laterite and porcellanite overlying the older formations at a slight depth—usually not more than 50 feet. The formations overlain by laterite are very variable. At Darwin we have them capping schists and greissens similar to those at West Arm, opposite Port

Darwin, on the Darwin Inlet, where these rocks crop out on the surface. At Bowen Straits, and thence along the northern and eastern coast, as far as the Pellew Islands in the Gulf of Carpentaria, it is generally the Permo-carboniferous sandstones that underlie the laterites, though from Cape Saunders to Blue Mud Bay the old metamorphic rocks frequently outcrop, the permo-carboniferous having been eroded away. The portion between Anson Bay and Port Keats has permo-carboniferous formations under the laterites, while from the Fitzmaurice to the Victoria River, older rocks, viz., Archdean and Cambrian again outcrop. The wide distribution of porcellanites and laterites over so many types of rock, over granite, sandstone, slate, schist, shale, quartzites, etc., proves that climatic forces had more to do with their production than geological considerations. Their present disintegration is attributable to two factors, namely, a wetter climate and an elevation of the entire country, bringing these chemically-formed rocks within the sphere of action of the forces of erosion.

HIGHLANDS.—The scenery of the hill country has all the characteristics of nature erosion. The river valleys are wide; the hills occur mostly in residual groups, the summits of which attan a very uniform level or even skyline, showing that they are the relicis of a peneplain. Here and there we have a larger block of tableland, capped with standstone or laterite, also attaining the general summit level of the zone.

The metamorphic pinnacles and razorbacks contain numerous quartz reefs, gossany lode outcrops, and mineralised zones.

Igneous rocks are well represented. There are large areas of granite, granodiorite, diorite and amphibolite (hornblendite) in the hill belt.

Physiographically the granite areas are distinguished by their fairly uniform erosion level, sandy soils, and typical eucalpyt flora, even where the rock is obscrued with detritus. Particularly acid belts of granite may present a rougher topography. Occasionally, a low rounded hill, bestrewn with tors and boulders reveal the naked rock which lies obscrued with rock waste in the more level country. The diorites and amphibolites (hornblendites) weather into rounded hills with chocolate soil mixed with boulders. Round the hornblendite hills we frequently get razorback ridges of adinole, resulting from contact metamorphism effected by the gabbroic intrusions which later, by regional metamorphism, were converted into hornblendite.

In the country of the Edith River, Nutwood Downs, the Victoria River, and Wave Hill, extensive areas of dacite and basalt, phonolite

and rhyolite, occur. The volcanic series to which all these belong is, in my opinion, of permo-carboniferous age. The Maude Creek volcanic series is of pre-Cambrian age, as pointed out by Dr. Woolnough.

The metamorphic pre-Cambrian rocks of the hill belt comprise slates, chlorite schists, mica schists, phyllites, quartzites, crystalline limestones, adinoles (lydian stone), amphibolites, and hornblendites.

Tin lodes are developed principally in the chlorite schists in the neighbourhood of tin granite, and in the tin granites and greissens themselves. Gold is most widely distributed in areas affected by amphibolitic and hornblendic intrusions. Copper is more widely distributed in all kinds of rocks, and galena, though not so plentiful, is also less confined to particular rock types. The best copper lodes occur in proximity to areas of a particular type of aplitic granite—the Mt. Davis type. In other words, tin is an emanation from a particular type of greisseny granite, the tin granite. Gold appears to be concentrated largely by lateral secretion out of hornblendic rock, magmatic vapours in the granitic period of regional metamorphosis having effected the concentration ; while copper and lead are products of the last phases of cooling of the granite magmas, the copper being particularly connected with the aplitic segration products.

Fossils are quite absent in the pre-Cambrian, and the areas are so contorted and disturbed that no clear rock sequence is yet discovered. It is, however, certain that the granites belong to the latest portion of the pre-Cambrian and had not yet completely cooled before the Cambrian, for we find areas of Cambrian limestone mineralised with quartz and gossan lodes, carrying copper and silver-lead-zinc. Thus, in the McArthur Station and Yah Yah limestones, which appear to be the same series as the Barkly Tableland limestone, we have copper and silver-lead-zinc lodes. Again, in a similar limestone formation, north of the Roper, the Mt. Maroomba silver-lead field, arg. ntiferous galena and zinc blende lodes occur. In isolated places in the Victoria River and Wave Hill country, copper ore and galena, accompanied by quartzy reefs and blows, occur in limestones, which are at least provisionally regarded as Cambrian.

At Sullivan's Creek, south-west of Delamere Station (Victoria River country), considerable quantities of native copper, in scattered lumps and nuggets, have been found. I have not seen the locality, but from descriptions communicated to me, and specimens inspected, it appears that these nuggets occur in a volcanic (basaltic) area, a portion of the Victoria River basalt area, and their origin is probably

like that of the native copper near Braidwood in N.S.W. Pre-existing lodes of cupriferous ore have been torn up by the ascending lavas, and the copper has been smelted out of these included fragments.

The country of the Nutwood Downs, Katherine, Wave Hill, and Victoria River drainage area, belongs geographically to the hill belt, being drained by coastwise streams, but physiographically it has the same characteristics as the "Great Plains" or 'Inland Plains." Limestone and basalt yield rich black soils, which do not favour aboreal vegetation. The climate is, therefore, more semi-arid, that is subject to more sporadic rainfall. Generally speaking, wherever the Cambrian limestones overlap into the hill belt, the country topographically and climatologically belongs to the inland plains area rather than to the hill belt. Nevertheless, throughout all the country drained by coast-flowing streams, the soil lacks salt, which, therefore, has to be imported for the cattle. On the inland drainage the soils are more saline, and salt bushes put in appearance.

The mesa-like sandstone tablelands, already referred to in the hill belt, have a very poor sandy soil; they are devoid of lodes and economic minerals, and are grassed with coarse spinifex. The most of Arnheim Land, north of the Roper, is a dissected tableland, whose elevation is said to reach 1,500 feet in its central portion. It is sandstone capped; but in the river valleys and valley walls the underlying mineral (Pre-Cambrian) series can be seen. The rivers dissecting it widen by the gradual retreat of almost vertical cliffs.

THE INLAND PLAINS.—These consist mostly of level country, seldom diversified by any conspicuous elevation. Excepting in the areas already mentioned as occupying an intermediate position between hill and inland topography, the drainage is inland. The real plains country in the portion of the N.T., north of latitude 20, consists of limestones and quartzites of Cambrian age. The limestones form black soil plains, treeless, without stones, except flint or ribbon stone pebbles, and without surface water. The quartzites are lightly timbered with mallees, wattles, hakeas and grivilleas, and are known as deserts. Frequently, clay holes in the quartzite areas carry permanent water. Both formations carry subartesian under-ground water supplies. Good supplies have been obtained throughout the Barkly Tablelands.

In those plains which are drained by coastwise streams, the limestones have a sprinkling of trees, chiefly bauhinia and mimosa. Corkwood and currajong occur also sparingly, also silver-leaved box and gutta-percha in suitable places. The volcanic areas of Nutwood Downs and the Victoria Downs also form plains country with chocolate

to black clay soil, and with Mitchell and Flinders grass. This country is more thickly timbered, and nutwood is one of the most abundant of its timbers. The soil is bestrewn with fragments of volcanic rock, pebbles of crystal quartz, and amethyst and chalcedony. The volcanic formations are not nearly so promising for sub-artesian water as the Cambrian, as the volcanics often attain enormous thickness, and are very hard to drill through with a jumper plant. That point should be noticed by station owners. They should avoid nutwood country in sinking for water, and where bores are absolutely essential in such belts they should employ a diamond drill or combination plant like the ' Victoria."

The limestones on the Katherine, Douglas, Wave Hill and Barkly Tablelands have been proved by their fossil contents, ill-preserved and sparing though they be, to be of Cambrian age. Mr. H. Y. L. Brown has found *Olenellus Forresti* and *Salterella Hardmanni* both on the Barkly Tableland, and at Wave Hill. The Katherine limestone is a real trilobite limestone in places, but the rock is so friable where the fossil nature is not obscured by silier-greation, that no specimens have been isolated. Tertiary mollusca occur in scattered places on the Cambrian limestone areas. They are, however, infilled lake depressions, and the limestone containing them is of a recent marly nature quite distinct from the main rock. The quartzites being distinctly interbedded must also be of Cambrian age.

As one proceeds inland along the overland telegraph line from the Katherine, or on the way to Tanami from Wave Hill cappings of permo-carboniferous sandstone are met with frequently on top of the Cambrian series. This formation is poor in soil, and characterised by lancewood, hickory, mallee gums, wattles and spinifex. The occurrence of lancewood in particular distinguishes the formation from the Cambrian quartzite areas on the head waters of the coast flowing streams, but this timber I have myself not met with on the inland waters, though it may occur. In general, the permo-carboniferous sandstones are much softer than the Cambrian quartzites, and, therefore, covered with deep sandy loam of a light red colour. The formation is very widespread on both sides of Hooker's Creek, and forms the jump-up or cliff escarpment between Wave Hill or Hooker's Creek. At Helena Creek, a branch of Winnecke Creek, between Hooker's Creek and Tanami, we met with pre-Cambrian rocks consisting of slates, schists, and quartz porphyries with saltbush, spinifex and Mitchell grass intermingled. A permanent rock-hole occurs here, and several soaks. The rock-hole is in an outcrop of quartzite, which appears to be belong to the Cambrian series.

Cambrian limestones and quartzites are the dominant formation between the Winnecke Creek pre Cambrian outlier and Tanami. Hence sub-artesian water should be obtainable in the area. With a reliable water supply, it should be magnificent pastoral country. The limestone country is well grassed and the quartzites areas teem in bushes eaten by horses and cattle with avidity. Wild orange, a species of capparis, is very abundant. The eucalypts are of the mallee type. Wattles, grevilleas and hakeas abound. At Frog Valley (Davidson's Wilson River), 80 miles north of Tanami, the granites and metamorphic formations outcrop locally, as they also do at Coomera Springs, 20 miles north of Tanami. At Tanami, commences a large area of pre-Cambrian metamorphic rocks with granite and diorite, stretching south and south-west for a great distance. The metamorphics are mostly schisted andesific buffs. At Black Rock, 20 miles south of Tanami, I noticed a serpentinous rock. In the Conglomerate Range, commencing 4 or 5 miles west of Tanami, Cambrian quartzites seem to be the preponderating formation. Here the Tanami rock-holes occur, and also the best well in the region. About 12 miles east of Tanami, I found a "jump down" showing rotten diorite in the escarpment. The reefs and lode formations at Tanami show gold to be widely distributed in them, and in highly payable quantities. Water shortage has been the great handicap of the field, but there is every reason to think that this difficulty can be surmounted.

Passing from Wave Hill to Tanami, the elevation above sea level gradually increases from about 700 feet to 1,400 feet.

In following the overland telegraph line south, the archœan or pre-Cambrian rocks are met with near Barrow's Creek in the Murchison and Davenport Ranges. In these, Davidson, the explorer, found lodes carrying gold, copper and silver-lead. Recently, payable wolfram has been found at Hatch's Creek, near the Frew River. Between Tanami and Barrow's Creek, there is an extensive depression fill d with sand, into which the Lauder River is supposed to flow, as well as Hooker's Creek and Winnecke's Creek. Out of this sandy waste rises isolated granite hills, near which Davidson found traces of gold. The fall from Tanami to the centre of this depression is over 500 feet. It rises again towards the McDonnell Ranges. The northern fringe of this depressed area is characterised by having water very near the surface, according to Dr. Chewings, the explorer, who obtained good water in numerous shallow wells he sank on his journey from Barrow's Creek to Wave Hill.

Generally speaking, the Cambrian formations predominate in the territory between latitudes 15° and 20° S., while south of lat. 20° S., the archœan and metamorphics outcrop are only isolated coverings of Cambrian quartzite, as seen at Conglomerate Hills, near Tanami (and as noticed by Davidson and Murray), and in the Davenport and Murchison Ranges.

The best pastoral country ot the Territory, lies therefore, between latitudes 15° and 20° S.

(*b*) Structural Geology.—The granite axis of the northern portion of the Territory, which is responsible for the mineralisation of the metamorphoric rocks north of the Cambrian areas, strikes W.N.W. From Darwin, we can trace it by its outcrops, through the Burrundi and Douglas granite areas, the Cullen-Ferguson granite area, and that of Maranboy (the new tinfield) to where it disappears under Cambrian formations. It outcrops at intervals through the Cambrian at the head waters of the Limmen and McArthur Rivers, and according to reports, received also at the head of the Nicholson and other streams flowing into the Gulf of Carpentaria. The granite axis trends, therefore, towards Cloncurry, and I have satisfied myself that the Cloncurry granites and metamorphic rocks belong to the same series as those of Coronet Hill and the Pine Creek district in the Territory. The main granite axis has offshoots along its course at right angles to it. These minor axes, or localised granite bodies, usually strike N.N.E., S.S.W.

A glance at the map of Australia shows that the trend of the McDonnell and White Ranges in Central Australia is also approximately W.N.W., so that the Cambrian formations lie in a synclinonium between two anticlinoria trending W.N.W.

(*c*) Stratigraphy.—The geological formations represented in the Territory, north of lat. 20° S., are :—

(*a*) Plutonic rocks : granites and diorites ; also greissen.

(*b*) Metamorphic rocks : slates, schists, cherts, quartzites, adinoles, metamorphic tuffs, greywackes, and amphibolites (including hornblendite after gabbro).

(*c*) Cambrian : limestones, quartzites and shales.

(*d*) Carboniferous ? or Permo-carboniferous ? the volcanic series of the Victoria River, including the Edith River series.

(*e*) Permo-carboniferous ; sandstones.

(*f*) Cretaceous ? sandstones and porcellanites.

(*g*) Tertiary : porcellanites, laterites and molluscan marls.

(*a*) Granite areas are numerous between Darwin and Katherine.

They occur also on the South and East Alligator Rivers (*e.g.*, Tor Rock), at Maranboy, on the Roper River, at Cape Saunders and Cape Grey on the Gulf of Carpentaria, on the Limmen River, the Nicholson, and inland at Winnecke Creek, Frog Valley, Tanami, the Murchison, Davenport Ranges.

True diorites occur in places in the Alligator River district, as reported on by Mr. Gray, B.E., B.Sc. They lie on an axis trending N.N.E., and appear to be later than the true granites.

(*b*) Slates, schists, cherts, and quartzites are widely distributed, and vary greatly in character. Most interesting are the tin-bearing chlorite schists of Hidden Valley and Horseshoe Creek. Definitely, pre-Cambrian crystalline limestones have only been observed at Burrundie and Eveleen. The Alligator River limestone areas are doubtful, but from occurrences on the Mary River, the balance of evidence is in favour of a Cambrian age. Adinoles are localised to the hornblendite areas, and seem to represent contact metamorphosed slates. The greywackes, so abundant in the Pine Creek goldfield, seem to represent metamorphosed tuffs. The amphibolites and hornblendites seem to represent metamorphosed basic tuffs and gabbros respectively.

Hornblendites are confined mainly to outcrops along an axis trending N.N.E. from the head waters of the Margaret River to the country between the Alligator and King Rivers.

(*c*) The Cambrian formations are easily distinguished from the pre-Cambrian. The latter are highly contorted, while the Cambrian folded strata are only and generally on an east-west strike, dips seldom exceeding 30°. The Cambrian quartzite formations are distinguished from the later sandstones by the fact that the latter are but slightly folded, dips seldom exceeding 10°.

(*d*) The Victoria Edith volcanic series strikes N.N.E. This appears to be the principal direction of weakness and fracturing in post-Cambrian times. This direction is perpendicular to the granite trend. The volcanic series is of a calcic nature, no sodic rocks having been observed.

(*e*) The permo-carboniferous sandstone series is only a thin capping in the western part of the mineral district, and on the inland plains, where it occurs in places. It thickens towards Arnheim Land and the Gulf of Carpentaria. At Borroloola, where fossil wood of calamitic nature occurs in it, and whence permo-carboniferous mollusca have been recorded by Mr. H. Y. L. Brown, it attains a thickness of at least 1,000 feet in places, and carries artesian water. Red, brown, black and mottled shales occur interbedded with the sandstone.

Between Anson Bay and Port Keats, on the west coast, the permo-carboniferous has been preserved to a thickness of 1,500 feet, by the subsidence of this belt in mesozoic times. Boring records show that it directly overlies granite.

The permo-carboniferous rocks have accumulated most thickly, and have been best preserved on granite foundations, hence often occur capping granite in mesa-shaped hills on the divides between rivers, the granites forming most of the divides in the mineral district of the Pine Creek railway.

The permo-carboniferous rocks lie almost horizontally in most places, but dips up to 20° have been observed in isloated cases.

(*f*) Large areas of rock regarded by me as permo-carboniferous have been considered to be cretaceous by Mr. Bown. The only definitely proved cretaceous deposit are some of the lateritic and porcellanitic cliff rocks near Darwin and the Alligator.

(*g*) Most of the laterites and porcellanites of the Territory I regard, in the absence of fossils, as cretaceo-tertiary, or early tertiary. Certain marls, in pockets, in the Daly River limestones, at the Flora Falls, and in the Barkly Tableland, carrying tertiary lamellibranches and gastropods, are probably late tertiary. There is no foundation for the erroneous idea, which has found its way into some text books, that the Barkly Tablelands consists of tertiary limestone, nor is there any evidence that their present elevation (700 feet) is of recent origin. The fossil marls accumulated in lake depressions.

The limestones of the Barkly Tablelands are full of subterranean passages and caves, as has been recorded by drillers. On striking any such cavern strong air currents pass in and out through the bore hole, the direction of the current being the reverse by day of that observed at night. "Swallow holes," hollows shaped like craters, or inverted cones, often lead from the surface to under-ground channels, and most of the creeks on the black soil plains terminate in a swallow hole.

IV.—CLIMATE.

The climate of the Territory is tropical, but as in other tropical semi-arid regions, healthy. The immediate vicinity of the coast is unpleasantly humid, both in dry and wet season, and consequently that irritating skin complaint, the prickly heat, is very prevalent and persistent in the coast belt. The heat from 100 miles inland and upwards is usually a dry heat, and much more endurable. Even so near Darwin as Brock's Creek, a great climatic difference is noticeable.

The temperature at Darwin, which is typical of the coast belt, seldom exceeds 98° in summer and seldom falls below 80° day or night. In winter (or dry season) the day temperature is usually between 80° and 90°, and seldom below 70° at night. What is characteristic of Darwin and the coast belt generally is that the wet bulb thermometer reads generally very nearly as much as the dry bulb, indicating high humidity. The diurnal range is seldom more than between 7° and 10°.

At Brock's Creek and Pine Creek, only about 100 miles inland (104 and 144 miles respectively on the railway line) the diurnal range is much greater. In the wet season, night temperatures as low as 70° are experienced frequently, and the day temperatures often reach 104°. In the dry season in these places, the night temperature occasionally falls to 48°, with day temperatures ranging between 75° and 80°. We, therefore, have in the hill belt a diurnal range of between 20° and 30° and cooler evenings, which render the climate much more pleasant than on the coast.

The diurnal range of temperature is even greater on the Barkly Tablelands and at Tanami. At Tanami, in November and December, 1913, I experienced day temperatures ranging from 100° to 110°, with corresponding night temperatures ranging from 60° to 70°, giving a diurnal range of 40°.

WIND.—The Territory winds are monsoonal. We have the N.W monsoon in the wet season, and the S.E. monsoon in the dry season, blowing with fair regularity. These monsoonal winds slacken off at the change of season, and calms may occur in early April and September. As September and October are usually the driest months,, this climatic feature militates against the use of windmills to raise water for stock in the interior.

On the coast the monsoonal winds blow for most of the year with the force of a strong breeze. On the inland plains they often attain the strength of a mild gale. At Tanami, high winds are very prevalent.

RAINFALL.—The year is fairly sharply divided into the rainy season commencing with the N.W. monsoon in October, and ending in February or early in March, and the dry season commencing in March or April with the advent of the S.E. monsoon. In the coastal belt from the West Australian border to Cape Wilberforce, the rainfall averages about 60 inches per annum. In the Gulf of Carpentaria country the rainfall is lower, being only about 25 inches in the McArthur River area.

The hill belt in the north-west of the Territory has a rainfall of about 40 inches, thus at Brock's Creek the average rainfall is about 48 inches, and at Pine Creek about 40 inches, the rainfall diminishing as one goes inland. In the Victoria River country, the average rainfall ranges from 40 inches near the mouth to 17 inches at Wave Hill near the source. These figures are, of course, only approximate, as not only are there large areas where no rain guages exist, and the rainfall is merely estimated, but where stations have rain guages very little attention is paid to reading them and recording the falls. At Tanami the rainfall is about 14 inches.

The long dry season leads to case hardening of rock formations. The shorter wet season, with its rainfall concentrated into a few short periods of intensely heavy downpours, leads to the soil waste being swept off the hills. The rugged topography of the hill country, the steep rocky slopes, and the wide clay flats at their base are, therefore, the natural result of rainfall characteristics. The low elevation of the hill country and the great distance to the sea, lead to widespread floods spreading over all the low lands and high rises in the rivers at periods of heavy downpour. The Katherine and King Rivers often rise 70 feet in flood time.

Cyclones of great violence occur at times, as shown by their tracks in the bush, where often every tree is uprooted for miles, and to a width of upwards of a quarter of a mile.

V.—SOILS.

(*a*) Coastal.—Porcellanite and laterite being the dominant geological formations, the soils are very poor, shallow, silicious, or ferruginous, except in alluviated depressions. Even where some distance back from the coast the older formations outcrop, the soils covering them are shallow (from the rapid wash away of waste by floods) and very leached. The best soils of the coastal belt near Darwin are the calcareous slate and limestone soils near Bachelor and Stapleton, but even these are rather shallow and leached. Moreover, they show another very common defect of Territory soils, namely, very great proverty in nitrogenous organic matter.

In a climate like that of the Territory, the first storms of the wet season wash away the accumulated leaves and organic remains deposited in the dry season. Rank growth of grass shoots up to a great height during the wet season. As soon as the dry season sets in it withers rapidly. In a few weeks it becomes the prey of great bush fires, which sweep the whole country. The ashes are swept skyward by the south-east monsoon, and the hot, dry sun of the dry season bakes the soil to the rocky bed.

Such conditions are very unfavourable for the production of fertile soils, and, therefore, fertile soils exist only in small alluviated pockets, and in small coastal-raised beach areas. The former are subject to floods and the latter of very small extent.

(*b*) Hill Country.—The characteristics of the soils of the coastal belt are shared by those of the hill country, and for the same reasons. The metamorphic rocks yield poor, shallow, stony soils on the hills and silicious clay flats between the hills. Granites do not yield such rough topography and have deeper soils, but they are hardly more than sand, being very leached. A few patches of dioritic granite and small belts near the junction of granite and amphibolite have a better soil, brown loam, suited for tobacco.

The pockets of good alluvial soil are subject to heavy flooding in the wet season.

(*c*) Inland Country.—The soils inland are for the most part rich in plant food, except when wholly derived from a very barren formation like sandstone or quartzite. But, naturally, the richness of the soil in mineral plant food varies inversely as the rainfall. Besides being enriched by their b ing outside the scope of leaching, many of the inland soils covering vast areas are derived from lime-rich rocks, such as Cambrian limestone and the Victoria River volcanics.

The limestone soils in the inner hill belt, such as on the Douglas River, at Katherine and elsewhere are leached, red, light loams, similar to typical wheat country in the Southern States. At Flora Falls, which partakes more of inland conditions, and at Victoria Downs, where the rainfall is still lower, the limestones yield chocolate and black soil plains of a very clayey nature. Excellent vegetables are grown on these soils at the various stations by irrigation, though the alkalinity of the well-water makes it essential to move the garden frequently.

The sandstones (assumed permo-carboniferous) between Wave Hill (Catfish Yards) and Winnecke's Creek, yield light red loams, very fertile and easily worked, which resemble those of Wagga in N.S.W., and would, in a Southern State, be regarded as first-class wheat country. It is also noticeable that, besides chemical leaching being slight in the interior, the mechanical removal of rock waste is also very slight, considerable depths of soil forming on hard sandstone and quartzite formations in the inland country, as between Wave Hill and Tanami.

VI.—NATIVE FOREST FLORA.

There is close relationship noticeable between the aboreal vegetation and geology, but although we may also observe a distinction in characteristics between coastal, hill country and inland, forest flora, there is considerable overlapping, many coastal species extending right away into the interior.

Generally speaking, the Territory is very poor in timber, especially useful timbers. In the coastal belt, the poverty of the soil, and the ravages of the white ant pest, stunt the timber, while inland the droughty conditions prevent any wild growth, even on those formations which are not, like the limestone, too alkaline in surface soil to produce aboreal vegetation.

Most of the coastal eucalypts are piped so as to be mere shells. The most compact and durable of coastal timbers are ironwood and cypress pine. Inland the eucalypts mostly assume the mallee habit. With them occur numerous species of acacia, grevillea, hakea, etc. All the inland eucalpyts and acacias are very rich in essential oils. Another characteristic of the inland trees and bushes is their spinose nature.

(*a*) COASTAL TIMBERS AND HILL COUNTRY TIMBERS.—There merge and overlap in such a way that they are best taken together. With the exception of cypress pine, which is a useful building timber, and ironwood, which is used for stumps of houses and fencing, and both of which are white ant resisting, most are very inferior. Some of the stringy bark and bloodwood species (like *E. tetrafona*, *E. Foelschiana* and *E. latifolia*) are fair for rails and for mining timber. The forest trees can be grouped into calciphile and calciphobe, the former prevailing on calcareous rocks and lime-rich geological formations, the latter on country poor in lime.

Calciphile Timbers.—In areas of coastal and highland country climatically resembling the inland slopes, like, for instance, McArchur Station, Flora Falls, the Victoria Downs, where limestone is the geological formation, Bauhinia, corkwood (*Erythrina Vespertilio*), mimosa (*Acacia Bidwelli* ?), and other timbers which range far into the inland plains predominate. Where typical limestones occur in the wetter districts, the above-mentioned inland timbers are rare or absent, while box (*E. melanohphloia* ?), occurs abundantly, with watergum (*E. papuana*), Foelsche's bloodwood (*E. Foelschiana*), bloodwood (*E. terminalis*), woolly butt (*E. miniata*), the diorite wattle (*E. Bidwelli*), corkwood, mimosa and cabbage gum (*E. grandifolia*). The same admixture of timbers occur on the Amphibolite, dionte and hornblendite soils in the Brock's Creek and Pine Creek mining

districts. Climatic considerations outweigh geological factors in deciding the class of calciphile timber on lime-rich rocks. Thus, some limestone areas would be described as box country, others as bauhinia country, others again as "plain."

COASTAL AND HIGHLAND CALCIPHOBE TIMBERS.—Poor Sandy Soil: On deep but poor sandy soil we find stringybark (*E. tetradonta*), woolly butt (*E. miniata*), and sometimes *E. Foelschiana* and *E. grandifolia*. These, therefore, dominate on granite and sandstone country. On shallow, sandy soil, such as occurs on hilly country, the snapper or salmon gum (identified provisionally by Mr. J. H. Maiden, F.R.S., as *E. alba*) is a very characteristic timber. It specially favours shallow, fine-grained sand-clay soils, such as occur on chert, slate, quartzite and silicious schist formations. Its light, reddish bark, and the bristleness of its branches account for the vernacular names. It is in such localities a small gum, crooked, mallee-like in often having a number of stems from the same root, and seems quite distinct from the tall, graceful tree (poplar gum) of the alluvial flats, which has also been assigned to *E. alba* by Mr. Maiden. The two trees are very similar in colour of bark, shape of leaf, and structure of pod and flower, but the hill species seems a pigmy and mallee-like variety, being a miniature in size as well as in the size of leaf, flower pod, and all constituent parts.

The following is a compendium of the habits of the coastal calciphobe timbers.

Stringybark (*F. tetradonta*), coastal and inland, deep sandy soils, chiefly on granite and sandstone.

Snapper gum (salmon gum, *E. alba*), coastal to inland slopes, shallow, poor soils, chiefly on chert, quartzite, and other fine-grained, compact, silicious rocks.

Moreton Bay Ash or Cabbage Gum (*E. grandifolia*), very widespread on soils of fair depth and loamy constitution, and occurs on any geological formation, provided the soil is not too clayey.

Bloodwood (*E. terminalis*), confined mainly to damp places with good depth of alluvial detritus. This is a tall, graceful tree, resembling *E. corymbosa*.

Foelsche's Bloodwood (*E. Foelschiana*), chiefly on soil of fair depth and medium quality, *e.g.*, slate, leached limestone soils, granite and mixed detritals.

Setose Gum (*E. setosa*), crooked, small tree with hairy branchlets and leaves; leaves are shed in dry season. Grows on very poor, sandy loams on granite and sandstone.

Bastard Bloodwood (*E. latifolia*), on loams of mixed geologic origin, fair in depth and quality.

Woolly Butt (*E. miniata*), on medium soils of fair depth and loamy nature.

Woolly Butt (*E. phœnicia*), on shallower, sandy loams as on aplitic rocks.

Papuan or Water Gum (*E. papuana*), confined to good, moist alluvials of considerable depth ; it is very commonly around springs. In Papua and North Queensland, where a moister climate prevails, this tree is very widespread.

Twin-leaved Gum (*E. houseana*), on clay flats subject to flooding in the wet season. The leaves are shed in the dry season.

Poplar Gum (*E. alba*), one of the largest trees of the Territory, and occurs on alluvial flats and clay flats subject to inundation. It sheds its leaves in the dry season.

Hill White Gum (*E. dichromophloia*), on shallow silicious soils and stony rubble covering slate and schist slopes and laterite.

Ironbark (*E. melanophloia* ?). This tree occurs only on a clay flat near Wandi. Though Mr. Maiden has tentatively assigned this tree and the N.T. white box to the same species, they are very distinct in appearance and habit. Mr. Maiden states this ironbark has some affinities with *E. crebra*.

Amongst other coastal calciphobe timbers not eucalypts the chief are :—

Cypress pine (*Callitris sp.*), on sandy soils covering granite and sandstone.

Ironwood (*Pithocolobium moniliferum*, chiefly on fair loams and not confined to particular geological horizons.

Lancewood (?), extending from the hill belt in Arnheim Land and Maranboy to the interior on sandstone formations.

Calythrix, Verticordia, and other scented " brooms," on stony places almost destitute of soil, especially on laterite.

Acacias, most widespread amongst which are *A. Auriculiformis*, *A. trimida*, *E. holosericia* and *A. latifolia*).

Hakeas, mostly on poor soils.

Grevilleas (*G. Chrysodendron*, etc.), mostly on sandy soils, in damp places, and very abundant on granite, sandstone, and quartzite flats. They indicate " spewy " or " boggy " country, forming almost a quicksand in the wet.

Buchanina (plum), careya, gardenia, and other fruit-bearing trees, some edible, some not flourish in loamy pockets, but cut out in the drier belts where wild orange (*capperis*) takes their place.

Milkwood (*Alstonia*), occurs as a large beautiful tree in the coastal parts.

One species of Casuarina grows along the shore; another is sparingly found in salt marshes near rivers.

Melalenca (several species), and pandanus, occur everywhere in moist places.

Along the low coast occur many species of mangrove, and along lagoons and watercourses a graceful tree known as freshwater mangrove.

Grasses.—The coastal and hill country grasses are profuse and rank in growth. Various species of Kangaroo grass and love grass, edges and reedy cane grasses, grow in the wet season to a height of 10 to 15 feet. Their nutritive value is, however, very poor, and the cattle lose condition during the time one would, from the state of the country, expect them to fatten. On the very shallow soils, no second growth comes after the autumnal bush fires, but in the Brock's Creek and Douglas River district, typical of the hill country, the deeper limestone and alluvial soils are enabled, by copious dews, to produce a second growth of real nutritious grass, which seldom attains a length of more than 12 inches. On the sandstone tablelands of the Arafura, Roper and McArthur country, the coastal spinifex occurs. The seeds of this is greatly relished by horses, but the grass itself is only eaten when young and green, just after burning.

(*b*) Inland Forest Flora.—The eucalypts are mostly confined to the light sandy soils of the interior, and are, therefore, mostly calciphobe. The chief calciphile eucalypts of the interior are silver-leaf box (*E. primosa*) and white box (*E. melanphloia* ?).

The calciphobe eucalypts are mostly of the mallee habit. The following species occur more or less between Wave Hill and Tanami and some of them also on the overland telegraph line :—*E. pachyphylla, E. peltata, E. tetragona, E. salubris, E. salmonophloia, E. oleosa, E. gamophylla, E. macrocarpa, E. saluboris*, etc. They are all on sandy loam country overlying sandstone and quartzite. They are associated with grevilleas, hakeas, acacias, and other bushes.

The calciphile flora of the interior comprises bauhinea, mimosa, corkwood, currajong, whitewood (a small straggling bush on the Barkly Tablelands, species of alstonia), and nutwood. Bauhinia favours limestone country, and nutwood is practically confined to the volcanics. In swampy tracts of the Barkly Tableland area we have a tree known as gutta-percha, and also belts of gidgee. The wild orange favours rich loams of a red or chocolate colour.

The inland grasses are on lime-rich country, like the Cambrian limestone and the volcanics, Mitchell grass, Flinders grass, blue bush, blue grass, and other nutritious species. On the Cambrian quartzites and permo-carboniferous sandstones, spinifex predominates, but it is relished by stock much more than the coastal spinifex. At Winnecke's Creek, I noticed a considerable amount of saltbush (*rhagodia sp.*) intermixed with other grasses on the porphyry formation. This also occurs on the granite country at Frog Valley.

VII.—RESOURCES OF THE NORTHERN TERRITORY.

The resources of the Territory are greater than our politicians realise, but great care and scientific insight are requisite in their development. So far, the mistake has been "putting the cart before the horse" in more ways than one. Demonstration farms should have followed experimental farms instead of preceding them.

(*a*) Agricultural Resources.—For reasons already given the agricultural resources are circumscribed. As far as the coastal belt is concerned only alluvial pockets along rivers and creeks and small raised beach, shell sand, areas along the shore have an agricultural value. The river flats being subject to heavy floods and standing water in the wet season, must be cultivated mainly in the dry season. by the aid of irrigation. This means considerable initial outlay The cultivable flats being only large enough for market gardens, and the local demand not being very great, it is clear that the rural industry can only be followed at a profit while there are few engaged in it, at least under present conditions.

The raised beach sands, of which the Darwin botanical gardens and Holmes' 8-mile garden are typical instances, grow cocoanuts and rubber to perfection, but the areas are so wretchedly small and so few that these are not going to do much to populate the Territory. Very much larger areas of red, friable loam, chemically of fair quality, occur on the limestone areas of the Douglas, Katherine, Flora and elsewhere. These areas can, however, only be successfully cultivated by the installation of great irrigation schemes, which are not warranted, while equally good areas are available in other States with better climate, facilities, and markets.

Inland.—The inland limestone areas are very productive under irrigation, as shown by the vegetable gardens at the cattle head stations, but neither would there be sufficient water for extensive irrigation at any point in the interior I have seen, nor would it be a feasible proposition since the soil would very soon be rendered too alkaline to produce anything. The soil is too clayey and heavy on the inland plains to be suitable for dry farming.

The most promising area of great extent for dry farming purposes which I have seen is the red loam area between Hooker's Creek and Winnecke's Creek on the Tanami track. This is true wheat country, but its development must await transport facilities, and the breeding, by scientific crossing, of a new wheat suited for the tropical parts of Australia. A cross between the Indian and one of the Australian wheats (especially one of the macaroni wheats) may suit this country.

Cotton has been much talked of as a likely crop for the Territory agriculturist. I have no faith in it. I found in my own garden that I could not grow the young cotton without watering in the dry season. Though all my plants were put in good, deep, well-tilled soil, only those which were specially irrigated survived the dry season.

Peanuts seem to do well on the river flats, but is not likely to be a payable crop.

Mountain rice does fairly well on the better lands in the coastal district, but it has little commercial value, being only eaten by the poorest of the Orientals, while hay and chaff made from it are not eaten by stock when they can get anything else.

The only crop I see any immediate future for in the Territory is tobacco, and it is the only weed the authorities seem to have left untried in their efforts at demonstrating failures. There are fairly large areas of granite and grandodiorite country in the hill belt which, with some irrigation from the permanent rivers, like the McKinlay, Mary, Douglas, etc., or even without irrigation, should grow excellent tobacco. It is a crop which can be made payable in small areas.

It is stated over and over again that our White Australia policy is in the way of the successful development of the agricultural resources of the Territory. A falsehood repeated often enough always finds adherents. So it is with this one. The obstacles to agriculture in Territoria are (i.) insufficient agricultural land in the coastal area to make more than a few small farms in any one district ; (ii.) necessity for expensive machinery to irrigate ; (iii.) very costly irrigation works required to utilise the rather better back country for agriculture ; (iv.) bad transport facilities ; (v.) want of local market.

(*b*) The Mining Industry.—The Territory, especially the hill belt portion, is well supplied with metalliferous lodes. Gold, silver lead, copper, tin, wolfram, molybdenite, and many other valuable ores occur. Lodes both prospected and unprospected occur in thousands through the hill belt. All these minerals are still mined in a desultory fashion, but many good fields are abandoned.

A careful examination of the past history of mining in the Territory shows that the failure of mining to make headway has been due to wild speculation, foolish expenditure of the resources of mining companies, flotation of bogus companies, which has acted detrimentally to the good mines, Chinese tributing, and bad administration and mining laws. The last-mentioned cause requires some explanation. The authorities in the boom days allowed the whites in the Territory (grocers, lawyers, clerks, engine-drivers, and other men not following mining) to take up mineral leases, and tribute them to Chinese, while the Chinese were prevented from holding any form of mining tenure except an alluvial claim. Hence, when a new field was discovered, the whole of the whites of the Territory rushed in and took up claims, which they tributed to Chinamen on very harsh terms. There was seldom any encouragement under these tribute agreements for the Chinese tributors to do any development work, or to put on pumping plant. The Chinese skinned the shows of all easily got at mineral, and then departed, leaving the fields a mass of unsightly holes and mullock heaps. There was no attempt at timbering, and the holes usually caved in the first wet season. When Southern miners arrived in the Territory, after hearing of a new discovery, they would find all the country pegged for miles by these parasites on Chinese tributors.

The distance of the Territory from the centre of Government, and the bad transport facilities prevailing, naturally favoured wild speculation, foolish expenditure of money, and often deception of the companies by the coloured reports of their managers, who were more often than not adventurers out to make as much as they could, and get back into a less torrid climate.

The Territory has vast mineral resources. Many of its lodes are of large size. Essential to success in the mining industry is considerable initial expenditure on machinery and development, on light railways and tramlines to facilitate transport, and on smelting works to do away with the necessity of sending ore out of the country to be smelted.

As investors are shy of the Territory, as a result of past experiences, it is essential that the Government incurs these outlays. Mining successfully established is the industry that will populate the Territory and will bring with it other industries.

A careful study of the mining fields has shown us that there is no reason, scientific or other, why the lodes should not live to a depth, though it is true that in many the ore becomes poorer below water level. Boring results have corroborated the conclusions arrived at by myself and staff, and have demonstrated the existence of gold

reefs at Pine Creek (Sagabiehl and Enterprise leases) carrying 4 oz. of gold per ton, and at the Union carrying 2 oz., at depths of 250, 400 and 700 feet in various places. Likewise, large bodies of ore have been demonstrated by boring to exist under the abandoned Iron Blow Mine and under Mt. Bonnie.

The following is a tabular statement and condensed description of the best known mineral fields of the Territory :—

(*i.*) *Gold Mining.*

Pine Creek : An area of saddle reefs, largely abandoned, but sure to come on again.

Union : Two well-marked fissure lodes, the Union and Lady Alice ; entirely abandoned except at one point, but will come on again.

Brock's Creek : Gold in laterals from a fissure lode or sheared zone ; not sufficiently concentrated for profitable mining.

Margaret and Shackle : Gold in lodes consisting of formations of sheared rock ; lodes very large but somewhat low grade ; should be payable if worked on a large scale.

Tanami : Very large lodes consisting of sheared formations, also quartz reefs in fissures. Very promising field which would be highly payable if transport and water difficulties were overcome.

(*ii.*) *Silver Lead.*

Evelyn : Fissure lodes and replacement bodies in limestone. Mines now abandoned, but could be re-opened if better transport facilities were established.

Mt. Bonnie : Sheared zone in slate ; very promising mine.

Mt. Shoobridge : Black lode ; true fissure lode.

McCarthy's Lode : Fissure lode in andalusite chiastolite schist.

McArthur River : Segregations in limestone ; abandoned and not payable. Large fissure lodes in the same country, not worked, probably complex and very zinciferous at a depth.

Boolman (Mt. Maroomba) : Similar to McArthur.

(*iii.*) *Copper.*

Iron Blow (near Grove Hill) : Abandoned ; copper and gold ; large ferruginous outcrop, large lenticular ore body, which has been shown by boring to persist to at least 400 feet. It gets more complex below 200 feet level.

Mt. Ellison (abandoned) : Fissure lode, probably not completely worked out, but barely large enough to warrant re-opening.

Daly River Mines : Fissure lodes, which have been worked slightly on the surface, but by the usual disgraceful Chinese methods, which have led to collapse of workings.

Mt. Davis, Mt. Diamond and Coronet Hill : Area of strong, large fissure lodes in granite and slate carrying arsenical copper ores. Lodes very numerous and ore fairly rich. With smelters at Coronet Hill and a light railway from Coronet Hill to Pine Creek or Union, the area should become one of the greatest copper fields in Australia.

Kilgour River : Several newly-discovered lodes scratched here, but transport difficulties in way of development.

Limmen River.—Several large lodes said to exist here.

(*iv.*) *Tin.*

West Arm : Tin, alluvial and in kaolin (gressien) lodes. Water very heavy at shallow depth. No great future for field.

Mt. Shoobridge : Greissen lodes and alluvial, now worked out.

Mt. Wells : Several strong fissure lodes very persistent in depth ; country rock slate.

Horseshoe Creek and Mt. Todd : Chlorite lodes in chloritic schist ; field ruined by Chinese mining, but by no means worked out.

Hidden Valley : Similar to Horseshoe Creek. The field promises to be a good one.

Hayes' Creek : Tin-quartz reefs in slate ; field not extensive ; working costs likely to be high.

Maranboy : New tinfield, numerous, very strong fissure lodes in chertified tuffs. Very promising tinfield. To assist development Government battery, 10 head, has been erected, in consequence of which ore as low as 3 per cent. can be made to pay handsomely.

(*v.*) *Wolfram and Molybdenite.*

Wolfram is mined at Wolfram Camp, where it occurs in a strong fissure lode in hornblendic hornfels, and at Hatch's Creek, where it seems to occur in pipes in granite. Molybdenite has been mined at Yenberrie near Horseshoe Creek.

VII.—PASTORAL RESOURCES.

The pastoral industry is already a permanently established industry in the Territory. The fine limestone and volcanic areas south of the Roper and Katherine are excellent fattening country, and good cattle country extends right to the 20th parallel. The Barkly Tablelands and the Victoria River stations are the best areas. The portions of the Territory lying north of the Roper and Katherine are tick-infested, and being grassed with rank inferior grasses, they are at the best only breeding country, but not to be greatly recommended even for breeding stock, since the cattle would probably become small in bone and body. Possibly a cross between Brahmin cattle and ordinary strains might do better on this country.

The bulk of the fine pastoral areas in the Victoria River drainage area, as well as many of the best stations on the Roper, have now been assimilated by Vesley Bros., a firm which has erected meatworks in Darwin at huge cost. The same firm owns many of the finest stations in West Australia, between Wyndham and Sturt's Creek. The natural port for its best properties is Wyndham, to which cattle can be driven through excellently grassed country almost to the water's edge. It is, therefore, strange that they have selected Darwin for meatworks, seeing that the cattle have to be taken from the great fattening stations upwards of 300 miles through inferior country, and then about 200 miles by train, losing condition all the time.

Of course they have their reasons.

It also seems a queer thing that meatworks costing three-quarters of a million have been erected in Darwin when statistics show that the cattle in the Territory number only about 410,000, which could be killed off by these works in less than 2 years.

The pastoral lands of the Territory are stocked to their fullest capacity under present conditions. This statement may seem extraordinary in view of my previous remarks describing the area and excellence of the N.T. cattle country. But it must be remembered as I have already pointed out, that on the inland plains permanent surface waters are rare. In the dry season the cattle gather round the permanent holes, and eat out the country for a radius of 10 miles, which is as far as a beast can walk daily for its feed. When the environment of the permanent waters is eaten out the cattle lie down in the water-holes and die of starvation, or fall down and die from exhaustion on the parched plains, where they have ventured too far in search of feed. The stocking capacity of the pastoral country is, therefore, only the capacity of an area equal the number of permanent water-holes multiplied by 10^2 x $3\frac{1}{7}$ square miles.

To fully utilise the vast pastoral areas of the Territory, numerous bores are essential, and as excellent sub-artesian water is known to occur in large quantities, the owners should be compelled to sink bores. But the areas in the hands of individual owners and companies are too large for them to grapple with the question seriously. Only a few stations on the Barkly Tablelands are doing creditable work to increase the pastoral value of their holdings. Even Vesley Bros. were only playing with the question of water boring when I was in Darwin, although lack of money scarcely accounted for their slowness.

The pastoral lands of the North-west, the Northern Territory, and Kimberley, are a big prize to secure a complete monopoly of, and in fishing for eels one must not pull the hook too soon. The

State meatworks at Wyndham have to be smashed before private enterprise is established supreme, hence there is no hurry to breed up cattle, no hurry to bore for water.

(*a*) The Pellew Islands.—The natural port for the Barkly Tablelands is the Pellew Islands. Between Centre Island and North Island lies a fine harbour with deep water almost to the edge of the land. Centre Island can be joined to South-West Island without any engineering difficulties by a bridge, and South-West Island can be similarly joined to the mainland. The straits are very shallow, that between the mainland and South-West Island being shallow enough to walk goats across at low water, that between South-West and Centre Island about 3ft. 6in. at low water. The tides are almost negligible in these waters ; there are no currents, and the harbour is well sheltered by high sandstone hills on the islands, which would also yield abundant material for building dams across the straits.

The advantage of the Pellew Islands as a port for the Barkly Tablelands, and a suitable place for meatworks, is accentuated by the fact that good cattle country extends from the Tablelands right to Borroloola, about 30 miles from the coast. The cattle taken down would not lose condition en route, though dipping against ticks might be essential, especially if the herds are to be held some time in the low country. The distance from the edge of the Barkly Tablelands (Top Spring) to the coast at the Pellew Islands is only about 100 miles. The permo-carboniferous sandstones, which form the country rock between Borroloola and the coast, and on the islands in an artesian area, which ensures a water supply for any settlement on the islands.

The Gulf about these parts teems in dugong and fishes. The coasts are mangrove-lined, and the enormous mangrove thickets on the river deltas should be of future value, both for bark and timber. Cypress pine grows plentifully on the sandstone backbones of these islands, and the coasts are lined with raised beaches, which are well suited for cocoanut plantations.

In the mangrove areas large edible crabs exist in astonishing abundance.

In the salt marshes at the mouth of the Weare River, south of the McArthur, large salt and gypsum deposits are formed every dry season after the annual high spring tide in March.

Pearl shell exists in fair abundance in the Gulf about Groote Eylandt, and trepang also lives here.

This coast, so rich in resources, with rich pastoral country behind, with undeveloped mining resources not far away, like silver-lead

on the McArthur, copper on the Limmen and Kilgour, gold at Blue Mud Bay, and other possibilities, is entirely uninhabited. The area was neglected by South Australia to which Darwin was the Territory.

Since the Commonwealth took charge it has been even more neglected. The small settlement at Borroloola is still without telephonic or telegraphic communication with the outside world, and they have to travel 300 miles, over dangerous dry stages, to Daly Waters, to send a wire ; very dangerous dry stages exist on the mail track to Camoweal, which could easily be wiped out by sinking a few bores. The Government, in 1913, took over the boat service between Darwin and Borroloola, and when the Government oil lugger was accidentally burnt, the McArthur settlement was left about 9 months without supply of stores, and starvation became so acute that most of the pioneers took ill, and many died of beri-beri. A party of six men went overland from Cloncurry to the Maranboy tin field, and only two reached their destination alive, the others perishing from starvation and beri-beri, resulting from the non-delivery of stores by the Government steamer. These things are not the fault of the Ministers in Melbourne, who mean well, but are due to the neglect and callousness of those men whose business it is, as Government servants, to see to the affairs of the Territory.

VIII.—RAILWAY CONSTRUCTION.

The Darwin to Pine Creek railway is now extended to the Katherine, and its construction is being continued to Bitter Springs, near the head of the Roper. The transcontinental line to Oodnadatta will, no doubt, be constructed approximately along the overland telegraph line from Bitter Springs, that being the most direct route. When finished it will do much good to the Territory. It will enable people in search of health to get south more quickly, or to get a change of air in the McDonnell Ranges. It will bring the Territory into closer touch with the labour market, and with Australia generally.

From the point of view of development, the lines which would do most good, after the Transcontinental, would be one from the Barkly Tableland to the Pellew Islands, and a light line to the Coronet Hill mining field.

Water boring and railway construction will do far more to develop the Territory than demonstration farms and meatworks.

Personally, I consider that the pastoral resources of the country will not be properly developed until the enormous areas held by a few firms are cut up into areas of about 100 sq. miles each. That

area is a comfortable living area for a pastoralist on similar country in Queensland. It is enough, and more than he can look after effectively without having to engage too much labour.

IX.—CONCLUSION.

In conclusion, I wish to warn members against the hastily-formed opinions of journalist "explorers." We have often, in recent years, read of exploring expeditions in the north-west, conducted by ambitious press men. No expedition can be considered an exploring expedition unless under scientific management, and conducted for a specific purpose. I personally place far more reliance on the plain narratives of bushmen and prospectors, who have travelled much, and observed closely, than on the literary eloquence of journalistic scribes. Apart from scientific expeditions for scientific purposes, there has been no exploration in Australia for the last 30 years; for every part of Australia has been traversed by bushmen. Even that dangerous, dry, desert-like region between Tanami and Alice Springs has been crossed and re-crossed by bushmen on horse-back. There is much scientific work to be done in Australia to increase our knowledge of our country and its resources, but exploring expeditions, without scientific guidance, are unnecessary, and only intended to place some journalist or newspaper in the limelight of the public gaze.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

Thirty-second Annual General Meeting, 24th August, 1917.

His Excellency Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S., &c., President of the Society, in the chair.

There was a large attendance, including Lady Goold-Adams and Captain Cosens, A.D.C.

The minutes of the previous monthly meeting of the Society were taken as read, and duly confirmed.

Elections.—Members: Dr. R. M. Allan, M.C., Messrs. E. T. Bell, M.L.A., David Cannon, A. J. Crowther, Ald. S. Greene, Mr. W. D. Grimes, Hon. Wm. Hamilton, M.L.C., Messrs. R. Joyce, J. McConachie, W. J. McGrath, Dr. T. R. McKenna, Dr. J. I. Moore, Hon. Sir Robert Philp, Kt., Messrs. Thos. Rice, R. E. Sexton, C.E., A. L. Simmons, and T. McI. Taylor.

The Hon. Secretary and Treasurer (Dr. J. P. Thomson) read the Annual Report of the Council, and submitted the financial statement, duly audited. These were adopted on the motion of the Hon. W. F. Taylor, M.D., M.L.C.,

seconded by Mr. J. P. Wilson, with an additional concluding paragraph to the report, expressive of high appreciation of the services rendered to the Society by His Excellency the President.

His Excellency, the President, then delivered his Anniversary Address, dealing with his tour in North Queensland, with lantern slides. The vote of thanks to the President, for his most interesting address, was moved by Mr. J. Stodart, M.L.A., and carried by acclamation.

The following officers and Council were elected for the Session 1917-18 :—

Patron : H.E. Rt. Hon. Sir Ronald C. Munro-Ferguson, P.C., G.C.M.G., LL.D. *President :* H.E. Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S. *Vice-Presidents :* J. P. Wilson, Esq., Hon. W. F. Taylor, M.D., M.L.C. *Hon. Sec. and Treas. :* Dr. J. P. Thomson. *Other Members of the Council :* James Stodart, Esq., M.L.A., B. L. Schooley, Esq., C.E., Capt. O. Svensen, J. A. Fraser, Esq., C.E., B. Dunstan, Esq., F.G.S., Most Rev. Archbishop Duhig, D.D., &c., E. J. T. Manchester, Esq., M.E., G. W. Whatmore, Esq.

Report of Council, Thirty-second Session, 1916-1917.

The Council have the honour of submitting to the Fellows and Members of the Society the Thirty-second Annual Report and Financial Statement for the year ending on the 30th June, 1917.

While it is gratifying to welcome to the Membership Roll of the Society an accession of thirty-one supporters during the year, it is felt that this number would have been materially increased had the exceptional privileges of fellowship been more widely known among the friends of town and country members, or even by those guests who attend the monthly meetings.

The losses occasioned by death include,—Sir Arthur Morgan, Gold Medallist, a former President, Fellow of long standing, and one of the warmest supporters of the Society, whose removal from the ranks of active workers is greatly deplored ; Sir Arthur Rutledge, an esteemed member, formerly Acting State Premier, and subsequently a Judge of the Supreme Court ; Dr. T. H. May, for many years Health Officer at Bundaberg ; and Capt. J. N. Graham, of Cooktown, a well-known Torres Strait Pilot.

In response to the Council's invitation, an essay was received in competition for The Thomson Foundation Gold Medal of the Society, on " The Settlement of Tropical Australia." In accordance with the condition of competition, this essay was identified by the motto " Scire vere est per causas vere," and was subsequently found to have been prepared by Dr. Griffith Taylor, Medallist of the Royal Geographical Society, London, Leader of Western Parties, Antartica 1912, and Physiographer, Commonwealth Weather Service, Melbourne. On due consideration, it was decided to accept the essay, and award its author the Thomson Foundation Gold Medal.

Although much curtailed by present war conditions, the library exchanges have been considerable, and as usual, cover a very wide field of scientific and technical inquiry, including the publications issued by the Commonwealth Government.

In the beginning of the Session, the Council received, as a donation to the Society from Mr. Oscar Fristrom, the well-known local artist, the portrait which he had painted of the Honorary Secretary and Treasurer, " in appreciation of Dr. Thomson's scientific and public services." To the generous donor the cordial thanks of the Society were given.

Included in the usual active work of the Session was the delivery of the following interesting and instructive addresses, with lantern illustrations :—

1. "The Island of Cyprus," being the Anniversary Address by His Excellency Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S., President of the Society.
2. "Three Months in the Hawaiian Islands," by Mr. Frederick Stubbs, F.R.G.S., Hon. Corresponding Member.
3. "Early History of Australia," by Capt. W. C. Thomson.
4. "The Colour and Habits of Birds According to their Distribution," by Mr. W. H. Dudley Le Souef, C.M.Z.S., M.B.O.U., Director Royal Zoological Society, Melbourne.
5. "A Trip to the Great Mountains, Central New Guinea, and the Industries of Papua," by Mr. Thos. J. McMahon.
6. "Recent Australasian Seismometry," by the Rev. Dr. E. F. Pigot, S.J., Science Master and Director of the Observatory, Riverview College, Sydney.
7. "The Northern Territory, Its Natural Features, Resources, and Possibilities," by Dr. H. I. Jensen, formerly Director of Mines and Government Geologist, Port Darwin.
8. "Munition Making in England," by Mr. Russell Sinclair, Executive Member, New South Wales Munitions Committee, Sydney.
9. Finally, the Sessional work will conclude with an address by His Excellency the President, who, it is understood, will refer to his recent tour in Northern Queensland.

To the contributors of these important communications the best thanks of the Society are tendered.

Following the customary procedure, it is presumed that the usual formal recommendations made by the Council for carrying on the work of the Society successfully during the ensuing year will meet with the approval of the Fellows and Members.

In conclusion, the Council desires to acknowledge the valuable services of Messrs. Robert Fraser, Hon. Auditor, and H. W. Mobsby, Hon. Lanternist, the latter having contributed much to the success of the monthly meetings.

It was unanimously decided, at the Annual General Meeting of the Society, that the following paragraph should be added to the Report of the Council :— "Finally, the Council, on behalf of the members at large, desire to express their very high appreciation of the splendid services rendered by His Excellency the President, who not only adorns the position, but has entered into the active life of the Society with rare zeal, enthusiasm and energy."

STATEMENT OF ACCOUNTS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND. FROM 1ST JULY, 1916 TO 30TH JUNE, 1917.

Dr.	£ s. d.	£ s. d.
By Funds at close of last Accounts—		
,, Balance in Government Savings Bank		73 16 11
,, Subscriptions Received ..		201 18 1
,, Sale of Journal		17 18 0
,, Interest on Government Savings Bank Deposit		2 5 5
		£295 18 5
,, The Queensland Public Service Assn.: Amount due for half cost of cleaning and lighting from July to December 1916	3 12 10	
Also half cost of repairs to chairs	1 6 6	
		4 19 4
		£300 17 9

Cr.	£ s. d.	£ s. d.
To Expenditure as per Accounts—		
,, Gas	0 18 0	
,, Fire Insurance Premiums ..	3 5 4	
,, Printing and General Postage ..	83 7 8	
		87 11 0
,, Advertising Meetings	5 15 8	
,, Cleaning, &c.	13 13 0	
,, Expenses of Meetings and Refreshments	27 4 8	
,, Repairs to Furniture and Fittings and Hire of Chairs ..	6 1 3	
,, Typing and Clerical	5 9 3	
,, Incidentals and Stationery ..	7 0 8	
,, Hon. Treasurer's Account ..	50 0 0	
,, Petty Cash	0 15 0	
,, Help in Library	1 15 0	
,, Cab Hire	2 10 0	
,, Wreath for Funeral (Sir Arthur Morgan)	1 5 0	
		121 9 6
,, Balance in Government Savings Bank		86 11 6
,, Exchanges on Cheques		0 6 5
		£295 18 5
,, Amount due by the Queensland Public Service Association		4 19 4
		£300 17 9

HAMILTON GOOLD-ADAMS.

J. P. THOMSON, Hon. Sec. and Treas.
14th July, 1917.

Examined with Bank Pass Books, Vouchers, &c., and found correct.
14th July, 1917. ROBT. FRASER, Hon. Auditor.

THE THOMSON FOUNDATION MEDAL FUND. BALANCE SHEET AS AT THE 30TH JUNE, 1917.

Liabilities.	£ s. d.	£ s. d.	Assets.	£ s. d.	£ s. d.
The Thomson Foundation Medal Fund		300 0 0	Fixed Deposit in the Bank of Queensland Ltd.		300 0 0
Balance in Government Savings Bank on 30th June, 1916 ..	15 10 3		Government Savings Bank ..		24 15 2
Deposit in Government Savings Bank 1916-17	11 5 0				
	26 15 3				
Less Freight on Medal Dies from London	2 13 1				
	24 2 2				
Interest in Government Savings Bank 1916-17	0 13 0	24 15 2			
		£324 15 2			£324 15 2

HAMILTON GOOLD-ADAMS.

Examined with Bank Pass Book, Vouchers, &c., and found correct.

14th July, 1917. ROBT. FRASER, Hon. Auditor.

J. P. THOMSON, Hon. Sec. and Treas.

14th July, 1917.

Thirty-third Annual General Meeting, 29th August, 1918.

His Excellency Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S., &c., President of the Society, in the chair.

The attendance was very large, and included Lady Goold-Adams, Lady Morgan, and His Grace the Most Rev. Archbishop Duhig, D.D.

The minutes of the previous monthly meeting of the Society were taken as read, and duly confirmed.

Elections.—Members: Messrs. Eric Elliott, E. F. Gilchrist, B.A., M.C.E., H. S. F. Moran, S. P. Paull.

His Excellency, the President, in reading the Report of the Council, expressed the hope that, when the Society again held its annual meeting, the war would be brought to a successful termination, and proposed a resolution, which was carried unanimously, by the audience standing, to the effect that as long as their support and assistance were desired by the Motherland, they would continue to give them.

The Hon. Secretary and Treasurer (Dr. J. P. Thomson) then submitted the financial statements, duly audited.

On the motion of Mr. J. P. Wilson, seconded by His Grace the Most Rev. Archbishop Duhig, the report of the Council and financial statements were adopted.

The following officers and Council were then elected for the Session 1918-19:

Patron: H.E. Rt. Hon. Sir Ronald C. Munro-Ferguson, P.C., G.C.M.G., LL.D. *President:* His Excellency Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S. *Vice-Presidents:* J. P. Wilson, Esq., Hon. W. F. Taylor, M.D., M.L.C. *Hon. Sec. and Treas.:* Dr. J. P. Thomson. *Other Members of the Council:* Most Rev. Archbishop Duhig, D.D., &c., B. L. Schooley, Esq., C.E., Hon. A. J. Jones, M.L.C., L. A. Wilkinson, Esq., J. A. Fraser, Esq., C.E., B. Dunstan, Esq., F.G.S., E. J. T. Manchester, Esq., M.E., G. W. Whatmore, Esq.

Dr. S. A. Smith then delivered a lecture on "The Dawn Man of Talgai: Its Bearing on the History of Man," with lantern slides.

The vote of thanks to the lecturer was moved by the Hon. W. F. Taylor, M.D., M.L.C., seconded by the Hon. Wm. Hamilton, M.L.C., and carried by acclamation.

Report of Council, Thirty-third Session, 1917-18.

The Council have the honour of submitting to the Fellows and Members of the Society, the Thirty-third Annual Report and Financial Statement for the official year brought to a close on the 30th June, 1918.

The accessions to the Membership Roll for that period number 28 supporters, and include several well-known representative citizens of the State, who are keenly in sympathy with the aims and objects of the Society.

By death the Society has suffered the loss of eight greatly esteemed members:—Mr. A. W. Cameron (former member of the Council), Hon. A. J. Carter, M.L.C., Messrs. D. R. Eden, Oscar Fristrom, R. F. Grimes, A. M. Hertzberg (also a former councillor), Hon. John Murray, and Mr. Edgar W. Walker, who for a term had held the office of a Vice-President.

The Council have much pleasure in reporting that The Thomson Foundation Gold Medal of the Society, awarded to Dr. Griffith Taylor, of Melbourne, last Session, for a thesis on "The Settlement of Tropical Australia," was presented

to the recipient by our Patron (His Excellency the Governor-General), on the occasion of an Investiture at the Federal Government House, Melbourne, on the 8th November, 1917.

Although the war has interfered greatly with the regular exchange of scientific literature all the world over, still the library of the Society has been enriched by many valuable works from kindred bodies and Government departments during the year, including several volumes of the Journal of The Royal Colonial Institute, donated by Mr. Warren Weedon, Life Member of the Society, to whom acknowledgment is due.

It is very gratifying to be able to announce that the capacity of the library has been increased, by the addition of a new wing of shelves, to accommodate the considerable number of publications that had for so long been piled up on the tables for want of shelving space, and this will meet the needs of the library for some time to come. The Council trusts that the greater facilities thus given to the members for studying the works in the library will be taken full advantage of by them.

One half the cost of this much needed addition has been very generously borne by Messrs. G. P. and Victor Campbell, the other half by certain members of the Council.

The practical work of the Session included the delivery of the following illustrated addresses :—

1. "The Historical Cities of Northern India," by Dr. R. Marshall Allan, M.C.
2. "The Wonderful Bird Life of the Southern Seas," by Mr. Dudley Le Souef, C.M.Z.S., M.B.O.U., &c.
3. "The Mining Industry of Queensland," by the Hon. A. J. Jones, M.L.C., Minister for Mines.
4. And, finally, there is the lecture to be given at this anniversary meeting on "The Dawn Man of Talgai : Its Bearing on the History of Man," by Dr. S. A. Smith, of Sydney.

The Society is deeply indebted to the respective gentlemen for the valuable nature of their lectures, and for the time and trouble expended by them in the preparation and delivery of their lectures.

The Council has pleasure in recommending :—

1. The suspension of so much of the "Rules" as provides for the payment of an entrance fee.
2. The re-appointment of Mr. Robert Fraser as Hon. Auditor and Mr. H. W. Mobsby as Hon. Lanternist.
3. The re-appointment of the Hon. F. T. Brentnall, Messrs. A. Muir, and Robert Fraser as Hon. Members of the Council.
4. The election of Lady Morgan as an Hon. Member, and the Hon. W. A. Holman, M.L.A., Premier of New South Wales, as an Honorary Corresponding Member of the Society.

In conclusion, the Council desires to acknowledge the valuable services of Messrs. Robert Fraser, Hon. Auditor, and H. W. Mobsby, Hon. Lanternist, the latter having contributed much to the success of the monthly meetings.

STATEMENT OF ACCOUNTS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND, FROM 1ST JULY, 1917, TO 30TH JUNE, 1918.

Dr.	£ s. d.	£ s. d.
By Funds at Close of last Accounts—		
,, Balance in Government Savings Bank		86 11 6
,, Subscriptions Received ..		197 19 0
,, The Queensland Public Service Assn., half cost of cleaning and lighting, from July to December, 1916		3 12 10
,, Interest on Government Savings Bank Deposit		3 9 9
		£291 13 1

Cr.	£ s. d.	£ s. d.
To Expenditure as per Accounts—		
,, Gas	0 13 0	
,, Fire Insurance Premiums ..	2 18 4	
,, Printing and General Postage ..	40 14 8	
		44 6 0
,, Advertising Meetings	2 14 9	
,, Cleaning, &c.	14 16 0	
,, Expenses of Meetings and Refreshments	10 15 6	
,, Repairs and Additions to Furniture, Fittings, and Hire of Chairs	4 4 3	
,, Typing and Clerical	3 9 2	
,, Incidentals	6 10 10	
,, Stationery	7 5 0	
,, Hon. Treasurer's Account ..	50 0 0	
,, Petty Cash	2 2 0	
,, Help in Library	7 7 0	
,, Telephone Rent	4 0 0	
		113 4 6
,, Balance in Government Savings Bank		134 2 7
		£291 13 1

Examined with Bank Pass Books, Vouchers, etc., and found correct.

ROBT. FRASER, Hon. Auditor.

1st July, 1918.

J. P. THOMSON, Hon. Sec. and Treas.

1st July, 1918.

THE THOMSON FOUNDATION MEDAL FUND. BALANCE SHEET AS AT 30TH JUNE, 1918.

Liabilities.	£ s. d.	£ s. d.	Assets.	£ s. d.	£ s. d.
The Thomson Foundation Medal Fund		300 0 0	Fixed Deposit in the Bank of Queensland Ltd.		300 0 0
Balance in Government Savings Bank on 30th June, 1917	24 15 2		Government Savings Bank ..		43 18 9
Deposit in Government Savings Bank 1917-18	18 0 0				
Interest in Government Savings Bank 1917-18	1 3 7				
		43 18 9			
		£343 18 9			£343 18 9

Examined with Bank Pass Books, Vouchers, &c., and found correct.

ROBT. FRASER, Hon. Auditor.

10th August, 1918.

J. P. THOMSON, Hon. Sec. and Treas.

10th August, 1918.

CORRESPONDENCE.

Toowoomba, 1st January, 1918.

The Secretary,
Royal Geographical Society,
Brisbane.

Dear Sir,

I do not know whether the following comes within the objects of your Society, but if so, it may be worth further inquiry.

As a partner in the firm of Gordon, Moreton and Co (the late Captain G. C. Gordon and the late Hon. M. H. Moreton), in the construction of the Cape York Telegraph Line, in the year 1886 (?), I was absent from the work for some considerable period, and on my return, my partners showed me a specimen of mineral, which they assured me was found by Mr. Frank Jardine, at present of Somerset, Cape York, and who discovered it on the Scarden River (a tributary of the Jardine River), or a creek running into the Skarden Creek. This specimen was sent to Professor Liversidge, of the Melbourne University, who pronounced it to be "zinc," in practically a pure state, and rarely found in the pure state.

I understood that Mr. Jardine could never locate the spot again, or I have never heard of his doing so. Such were the particulars as related to me, and I had no reason to doubt them.

If your Society is sufficiently interested, I would suggest that you write Mr. Frank Jardine, Somerset ; as, if the statement is correct, a deposit of zinc may be of importance to the Empire, and even though nothing may be done with the matter at present, a record of the particulars may be of use to future generations.

Yours faithfully,
FRANK J. PATERSON.

Somerset, 4th January (February) (?), 1918.

Dear Sir,

I beg to acknowledge the receipt of your letter, 21st January, and reply hereby. 35 years is a long time to look back over, and supply accurate date and particulars concerning happenings which occurred then,—unless of importance or value—in a day after day wearying and monotonous trip. However, I will try and supply, from memory, the information you ask for, and regret it is so unsatisfactory and meagre.

The specimen of "native" zinc referred to was found, I think, on Louisa Creek, a short distance below the present crossing of the telegraph line.

On discovering it, I was unable to place it among metals, and thought I had "struck something good," and made diligent search in the creek, above and below the spot, and after "washing out" many dishes of "stuff," this solitary specimen was all I could find.

Louisa Creek runs into the McHenry River, a tributary of Jardine River, and distant 9 miles from the telegraph line crossing of the latter.

On my outward trip, when making the route for the overland telegraph line from Cape York to Oven, after reaching camp, and plotting up, and straightening out my day's work, would—if any indications—spend my time

prospecting, and on my homeward bound trip would thoroughly examine any likely looking places marked down on my outward trip; but with the exception of a few ~~colours, and~~ the isolated specimen of zinc, without success, as in its endowment of minerals, the 250 miles of country through which I passed was barren and unkind.

It may not be out of place to mention here, for your information, that Gordon, Moreton and Company's line-clearing party consisted of from 40 to 50 men, and among the axemen there was a large proportion of miners, who were induced to undertake the job solely in hopes of " striking something rich " in the 250 miles of practically virgin country through which the line would pass, and not for the comparatively low wages of 8s. per diem.

For the posts, the men took the contract to dig the holes—4 feet deep—many of them through " hard " country, which required shooting with dynamite; but a miner's vivid imagination saw gold at the bottom of each.

Saturday afternoons, Sundays, and every moment of spare time, was devoted enthusiastically to prospecting along the route, eventually all to end in disappointment; and as the telegraph party had a temporary depot at Louisa Creek—although I did not make my find public—the place got a fairly thorough overhaul by the miners in their spare time; but without any tangible results. With kind regards.

Yours truly,

FRANK L. JARDINE.

Royal Geographical Society of Australasia,
QUEENSLAND.

Founded 1885.

THE THOMSON FOUNDATION GOLD MEDAL.

Awards.

The Thomson Foundation Gold Medal of the Royal Geographical Society of Australasia, Queensland, established in 1900, in honour of Dr. J. P. Thomson, the Founder of the Society, shall be awarded annually, or at such other times as the Council may approve, to the author of the best original contribution to Geographical Literature, provided it be of sufficient merit, approved and accepted by the Council. Special awards of the Medal may also be made from time to time to such persons as have gratuitously rendered eminent services to the Society.

The following are the names of the recipients of the Medal, the grounds of the award being noted only briefly here, but are given more fully in the " Journal," to which reference is hereafter made:—

1901—**Dr. J. P. Thomson**—for his great serivces to Geographical Science. *Vide Queensland Geographical Journal*, vol. xv., pp. 133-134; vol. xvi., pp. 132-135, 141-142.

1906—**Sir Hugh M. Nelson**—for his valuable services to the Society. *Vide Queensland Geographical Journal*, vol. xxi., p. 151.

1910—**Sir Arthur Morgan**—for valuable services rendered to the Society, *Vide Queensland Geographical Journal*, vol. xxv., p. 144.

1917—**Dr. Griffith Taylor**—for " Thesis on the Settlement of Tropical Australia," *Vide Queensland Geographical Journal*, vol. xxxii.-iii., p. 1.

Royal Geographical Society of Australasia,

QUEENSLAND.

Founded 1885.

Diplomas of Fellowship.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 3, Constitution and Rules (*See page* 2 of *Cover*) :—

Honorary:

The Right Hon. Sir William MacGregor, P.C., G.C.M.G., C.B., M.D., LL.D., D.Sc., Hon. F.R.S.G.S., &c.

The Right Hon. Lord Lamington, P.C., G.C.M.G., G.C.I.E., B.A., F.R.G.S., Hon. F.R.S.G.S., &c.

The Right Hon. Sir S. W. Griffith, P.C., G.C.M.G., M.A., &c.

Professor J. W. Gregory, D.Sc., F.R.S., Geological Department, University, Glasgow, Scotland.

Under subsections (a and b) :—

Charles Battersby, Esq., J.P.
*Robert Fraser, Esq., J.P.
*E. M. Waraker, Esq., J.P.
*R. M. Collins, Esq., J.P.
Alexander Muir, Esq., J.P.
C. B. Lethem, Esq., C.E.
*John Cameron, Esq., J.P.
*Hon. Sir Arthur Morgan, Kt., F.R.G.S., &c.
Hon. C. F. Marks, M.D., M.L.C. &c.
Hon. F. T. Brentnall, M.L.C.
James Stodart, Esq., M.L.A.
J. R. Atkinson, Esq., L.S., J.P.
L. F. Schoenheimer, Esq., J.P.
Ald. John Crase, J.P.
L. C. Horton, Esq., J.P.
J. T. Embley, Esq., L.S.
Rev. L. L. Wirt, B.D.
Capt. W. C. Thomson
R. H. Mathews, Esq., L.S., J.P., &c.
*T. S. Sword, Esq., J.P.
George Phillips, Esq., C.E.
A. A. Spowers, Esq., J.P., &c.
A. S. Kennedy, Esq.
Alexr. Corrie, Esq., J.P.
Major A. J. Boyd

* Dead.

List of Members.

(P) Members who have contributed papers which are published in the Society's "Proceedings and Transactions." The numerals indicate the number of such contributions.

(PP) Past President.

A dagger (†) prefixed to a name indicates a member of the Council.

Life members are distinguished thus (*).

Should any error or omission be found in this list, it is requested that notice thereof be given to the Hon. Secretary.

Foundation Members:

P1 Allardyce, His Excellency Sir Wm. L., K.C.M.G., Govt. House, Nassau, Bahamas.
Alton, R., Brisbane.
Armour, R. L., J.P., Brisbane.
P1 Atkinson, J. R., L.S., Ipswich.

Bailey, T. S., Survey Department, Brisbane.
P1 Bartley, N., Brisbane.
Bell, W., Supreme Court, Brisbane.
P1 Bennett, E. J., Survey Department, Brisbane.
Brydon, J. M., J.P., Brisbane.

Coghlan, J., Mount Eagle, Cooyar.

Daniell, E. N., Survey Department, Brisbane.
Davidson, W. M., Deputy Surveyor-General, Brisbane.
Drury, E. R., C.M.G., General Manager Q.N. Bank, Brisbane.

Ferguson, J., J.P., Brisbane.
Foxton, Hon. J. F. G., Brisbane.
Fraser, T., L.S., Brisbane.

Gailey, R., J.P., Brisbane.
P9 PP Gregory, Hon. Sir A. C., K.C.M.G., M.L.C., F.R.G.S., &c., Brisbane.

Heath, G. P., J.P., Comm. R.N., Brisbane.
Heeney, F. X., J.P., Lands Department, Brisbane.
P1 Hennessy, Capt. J. M., New Guinea.
Hoggan, R., B.A., Survey Department, Brisbane.
P1 Hull, A. A., L.S., Survey Department, Brisbane.

Langford, W. H., Survey Department, Brisbane.
Lavarack, Major C. W., Survey Department, Brisbane.
P1 Leonard, G. A., L.S., Yorick Club, Collins Street, Melbourne.
Lilley, Hon. Sir Charles, Kt., Chief Justice, Brisbane.
Lloyd, W. M., J.P., Brisbane.
Luck, H. C., F.R.G.S., J.P., Commercial Travellers' Club, Elizabeth Street, Brisbane.

LIST OF MEMBERS—*continued.*

Macpherson, Hon. P., M.L.C., Brisbane.
Marks, Hon. C. F., M.D., M.L.C., FELLOW, Wickham Terrace, Brisbane.
McDonald, G. T., L.S., Rocklea.
McDonnell, E., J.P., Brisbane.
McDonnell, J., J.P., Brisbane.
McMaster, J., M.L.A., Brisbane.
Mein, His Honour Mr. Justice C. S., M.A., Brisbane.
P2 PP Miskin, W. H., Brisbane.
P1*Moore, T. B., F.R.S.,Tas., New Norfolk, Tasmania.
Morehead, Hon. B.D., M.L.A., Brisbane.
P1†Muir, A., J.P., FELLOW, "Menzies," Brisbane.
Muir, J., J.P., Brisbane.

O'Connor, T., L.S., "Duporth," Oxley, Brisbane.

Persse, T. K., Survey Department, Brisbane.

Raff, H., L.S., Brisbane.
P1 Romilly, Hon. H. H., Port Moresby, New Guinea.
Russell, H. H. A., Immigration Department, Brisbane.
Ryan, R. A., J.P., Brisbane.

Stanley, F. D. G., F.R.S.B.A., Brisbane.
P1 PP Stodart, J., FELLOW, Market Street, Brisbane.

Thomson, John, M.B., &c., Brisbane.
P39 PP†Thomson, J. P., LL.D., Hon. F.R.S.G.S., &c., Hon. Sec. and Treasurer, Brisbane.
Trower, H., Survey Department, Brisbane.
Tully, W. A., B.A., F.R.G.S., Surveyor-General, Brisbane.

Viner, A. J., Brisbane.

P1 PP Waugh, J. N., M.D., Brisbane.
Williams, W., J.P., Brisbane.
Wilson, R. W., J.P., Brisbane.
Wilson, W. H., Brisbane.
P1 Woolnough, Rev. G., M.A., Brisbane.
Wright, H. T., Comm., R.N., Brisbane.

LIST OF MEMBERS—*continued.*

Members.

Abell, E., Garland, J.P., 187 Queen Street, Brisbane.
Affleck, Thos. H., "Westhall," Freestone, Warwick, Q.
Alford, Henry King, J.P., "St. Audries," Toowoomba, Queensland.
Allan, David Muir, Engineering Supply Co. Ltd., Edward Street, Brisbane.
Allan, Dr. R. M., M.C., Hampstead Road, South Brisbane.
Allom, C. V., c/o. B.P. and Co., Apia, Samoa.
Allom, S. R. F., F.F.I.A., F.C.P.A., 268 Edward Street, Brisbane.
Appel, Hon. J. G., M.L.A., "Sea Glint," Elston, Southport, Q.
Archer, Edward Walker, J.P., Commercial Union Chambers, Eagle Street, Brisbane, Queensland.

Barnes, Hon. W. H., M.L.A., J.P., Milson Street, Coorparoo, Brisbane.
*Barrett, Mrs. Walter, Eagle Junction, Brisbane.
Barton, E. J. T., Town Hall Chambers, Brisbane.
P1 Barton, E. C., F.R.G.S., M.I.E.E., F.R.M.S., City Electric Light Co., Boundary Street, Brisbane.
Battersby, C., J.P., FELLOW, Georgetown, Queensland.
Baynes, Harry, J.P., Water Street, South Brisbane.
Beard, J., "Glenrock," Moorooka, near Brisbane.
Beck, John George Henry, J.P., Morton Street, Eidsvold, Q.
Beirne, Hon. T. C., M.L.C., Brunswick Street, Valley, Brisbane.
Bell, E. T., M.L.A., Coochin Coochin, Queensland.
Berkman, Marcus, Emily Street, Highgate Hill, South Brisbane.
Bird, J. T. H., Public Works Commission, Treasury Buildings, Brisbane.
Blackman, A. H., Chief Engineer's Dept., Railway Offices, Brisbane.
PP Blair, Hon. J. W., Ipswich, Q.
Bond, H. E., J.P., 289-291 Queen Street, Brisbane.
Borton, Mark W., Land Commissioner, Toowoomba, Queensland.
Bourne, Dr. H. T., Red Hill, Brisbane.
Bowden, Mrs. H., Kingaroy, Q.
P2 Boyd, Major A. J., FELLOW, Dept. of Agriculture and Stock, Brisbane.
P4 PP†Brentnall, Hon. F. T., M.L.C., FELLOW, "Eastleigh," Coorparoo, Brisbane.
Brown, J. Leonard, J.P., "Woggonora," Cunnamulla, Q.
Brown, Thos. H., J.P., Messrs. Thos. Brown and Sons, Ltd., Eagle Street, Brisbane.
Bruce, Capt. J. A., Goode Island, *via* Thursday Island, Torres Strait, Queensland.
Buchanan, Ald. C. P., B.A., Auction Mart, Queen Street, Brisbane.
Buchanan, A. J., M.A., LL.B., "Daily Mail" Office, Brisbane.
Bull, Arthur, Box 121, Durban, S. Africa.
Bunning, G. E., J.P., "Tarong," Blakeney Street, South Brisbane.
Burtt, Frank, Secy., Outridge Printing Co., Ann Street, Brisbane.
Butler, John Henry, Messrs. Butler Bros., Charlotte Street, Brisbane.

Calvert, Thomas, J.P., Box 67, Proserpine, Q.
*Cameron, Pearson Welsby, J.P., Nicholas Street, Ipswich, Q.
Campbell, G. P., J.P., Messrs. Jas. Campbell and Sons Ltd., Creek Street, Brisbane.

LIST OF MEMBERS—*continued.*

Campbell, Victor F. J., Messrs. Jas. Campbell and Sons, Ltd., Creek Street, Brisbane.

*Campbell, A., J.P., Glengyle Station, Birdsville, Queensland.

Campbell, Norman, City Engineer's Office, Brisbane.

Cannon, D., "Como," Yeronga, near Brisbane.

Cartledge, John Colenso, 246 Umbila Road, Durban, Natal, S. Africa.

Carvosso, William Henry, J.P., Sheriff and Marshall, Supreme Court, Brisbane.

Cobden, Richard, Brisbane Club Chambers, Adelaide Street, Brisbane.

Colclough, E., Officer in Charge of Records, Lands Department, Brisbane.

Collins, C. J., Tamrookum, Beaudesert, Q.

Corlass, E. J., "Wyuna," Ormand Street, Ascot, Brisbane.

*Corrie, Alex., J.P., FELLOW, "Parbury House," Eagle Street, Brisbane.

Pl Crase, Ald. John, J.P., FELLOW, Warren Street, Fortitude Valley' Brisbane.

*Crorkan, T., J.P., ———

Crowe, Dr. P. F. V., 628 Ann Street, Brisbane.

Crowther, A. J., Secy. Railway Department, George Street, Brisbane.

Crowther, S., J.P., "Beechfield," Dornoch Terrace, South Brisbane.

Pl Cummins, J. J., Authorised Surveyor, c/o. Survey Office, Brisbane.

De Conlay, James, J.P., Warwick, Q.

Deshon, C.E., L.S., M.S.E.(Lon.), Hydraulic Engineer's Department, Brisbane.

Doggett, Ald. Harry, J.P., 35 Arthur Street, Fortitude Valley, Brisbane.

Douglas, Henry Alexander Cecil, 529 Queen Street, Brisbane.

Down, Alderman G., J.P., Ward's Chambers, Queen Street, Brisbane.

†Duhig, His Grace the Most Rev. Archbishop, D.D., Dara, Brisbane.

†Dunstan, Benjamin, F.G.S., Govt. Geologist, Brisbane.

Pl Edwards, Edward E., B.A., Telegraph Building, Brisbane.

Effey, William, J.P., Central Buildings, Edward Street, Brisbane.

Elliott, Eric, Messrs. Elliott Bros., Eagle Street, Brisbane.

Embley, J. T., FELLOW, L.S., Ascot Vale, Melbourne, Victoria.

Evans, Col. Charles, J.P., C.M.G., Clayfield, Brisbane.

Fahey, Hon. B., M.L.C., Parliament House, Brisbane.

Fairfax, J. Hubert, J.P., "Marinya," Cambooya, Q.

Ferguson, His Excellency Rt. Hon. Sir Ronald C. Munro, P.C., G.C.M.G., Patron, Federal Government House, Melbourne, Victoria.

Finlayson, M. H., J.P., Fruit Exchange, Turbot Street, Brisbane.

Finlayson, W. F., M.P., "Blairadam," Roberts Street, Toowong, Brisbane.

Fish, George, J.P., South Brisbane.

Fisher, Rt. Hon. Andrew, P.C., High Commissioner for Australia, London, England.

FitzGerald, C. A., c/o. City Electric Light Co., Boundary Street, Brisbane.

*Foot, J. A., J.P., Warrinilla, Rolleston, Queensland.

List of Members—*continued.*

P1 Ford, F. B. Campbell, Deputy Surveyor-General, Brisbane.
Forsyth, James, M.L.A., "Braelands," South Toowong, Brisbane.
Fox, C. B., Messrs. Nicol Robinson, Fox and Edwards, Solicitors, Queen Street, Brisbane.
Frankel, Philip, J.P., "Strathmore," Bowen Terrace, Brisbane.
†Fraser, J. A., C.E., Deputy Chief Engineer, Railway Department, Brisbane.
Fraser, Captain C. Sankey, Queen Street, Brisbane.

Gibson, Hon. Angus, M.L.C., Bingera, Q.
*Gibson, D. W., Staff Surveyor, c/o. Survey Office, Brisbane.
Gilchrist, E. F., B.A., M.C.E., City Engineer, Brisbane.
Gillies, R. G., J.P., City Printing Works, 111 Queen Street, Brisbane.
Goodman, George, Alfred Street, Charleville, Q.
Gorringe, J. A., Authorised Surveyor, Kempton, Tasmania.
P3†Goold-Adams, His Excellency Major Sir Hamilton J., G.C.M.G., C.B., F.R.G.S., &c., &c., President, Government House, Brisbane.
Graham, Thomas, J.P., Morningside, Q.
Graham, Mrs. Thos., Morningside, Q.
Greene, Miss Alice J. Alison, Principal, Moreton Bay Girls' High School, Wynnum.
Greene, Alderman S., Wynnum, Queensland.
Greenham, Dr. Eleanor Constance, Edward Street, Brisbane.
Greensill, E. H. R., C.E., Authorised Surveyor, Chief Engineer's Department, Railway Offices, Brisbane.
Griffin, William Charles, J.P., Somerset Farm, Gordon Vale, near Cairns, Q.
P1 PP Griffith, Rt. Hon. Sir S. W., P.C., G.C.M.G., M.A., LL.D., &c., Chief Justice of Australia, "The Albany," Macquarie Street, Sydney, N.S.W.
Grimes, W. D., "Tarragindi," Cracknell Road, South Brisbane.
Gunn, Donald, M.L.A., Parliament House, Brisbane.

Hall, Thomas, Annerley Road, South Brisbane.
Hall, T. R., Architect, "Bathmundi," Edmondstone Street, South Brisbane.
Hall, Hon. T. M., M.L.C., Parliament House, Brisbane.
Hamilton, Hon. W., President Legislati e Council, Parliament House, Brisbane.
Hannaford, S., J.P., "Utopia," Stanthorpe, Queensland.
Harbord, H. H., J.P., Maytown, Queensland.
*Hart, J. H., "Culterfel," Manly, Queensland.
Haviland, C. V., Govt. Land Buyer, Port Moresby, Papua.
Hayes, J. A., J.P., "Goonan Goonan," Sandgate, Q.
Hetherington, Ald. J. W., J.P., Main Street, Kangaroo Point, Brisbane.
*Hill, Mrs. Lumley, Belle Vue House, Bellevue, Q.
Hillcoat, Reginald E. R., J.P., Boomarra Station, *via* Donaldson, Queensland.
*Hodel, F. C., J.P., Cairns, Queensland.
P1 Hogarth, Mrs. William, Stonehenge, Millmerran, Q.

LIST OF MEMBERS—*continued.*

Holmes, E. J., J.P., Messrs. Holmes and Church, Queen Street, Brisbane.

*Holt, W. H., F.R.C.I., "Glanwyne," Manly Point, Manly, N.S.W.

Pl *Horton, Leonard Cecil, J.P., FELLOW, "The Gunyah," Johnstone River, Q.

Irving, J. Washington, M.R.C.V.S.L., Ann Street, Brisbane.

Irving, W. Edmund, "Lorina," Kirkland Avenue, Coorparoo, Brisbane.

Jackson, T. D., Eagle Street, Brisbane.

Jacob, W. S., Managing Director and Secretary, Messrs. John Hicks and Co., George Street, Brisbane.

Jenkinson, C. M., J.P., "The Herald" Office, 42 Elizabeth Street, Brisbane.

Pl Jensen, Dr. H. I., Geological Survey Office, Brisbane.

Jensen, Thor H., Authorised Surveyor, Treasury Chambers, George Street, Brisbane.

Johnson, William Guard, J.P., Palmerin Street, Warwick, Q.

Johnston, Robert Henderson, F.V.C.M., F.I.G.C.M., Limestone Hill, Ipswich, Q.

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Pl †Jones, Hon. Alfred J., M.L.C., Parliament House, Brisbane.

Jones, Daniel, 138 Petrie Terrace, Brisbane.

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Leahy, Hon. P. J., M.L.C., 293 Queen Street, Brisbane.

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*Lewis, A. A., J.P., Oxley, near Brisbane.

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Macdonald, Hamilton and Co., The Manager, Mary Street, Brisbane.

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Mackenzie, W. B., J.P., Manager, Queensland National Bank, Valley, Brisbane.

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Nally, P. J., Intelligence and Tourist Bureau, Brisbane, Q.
Needham, F. H., J.P., 37 Marlborough Street, Drummoyne, Sydney, N.S.W.
Nicholas, C. E., J.P., "Highlands," Samford, Queensland.

O'Hara, R. E., J.P., New Park, Ballymoch, County Sligo, Ireland.
O'Reilly, Charles, J.P., Dornoch Terrace, South Brisbane.

Paine, A. A., J.P., "Illalong," Brandon, *via* Townsville, Queensland.
Parker, William Richard, L.D.S., Eng., dentist, Edward Street, Brisbane
Parkinson, F. C., Elizabeth Street, Brisbane.
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McLeod, Alex., J.P., Elizabeth Street, Brisbane.
McLeod, J. J. W., Upper Esplanade, Sandgate Q.
McWilliam, T. M., Manager, Messrs. Brabant and Co., Charlotte Street, Brisbane.
Menzies, A. R., D.D.S. (Penn.), L.D.S., R.C.S. (Edin.), L.D.S.Q., 63 Queen Street, Brisbane.
Merrington, Rev. E. N., M.A., Ph.D., Crowther Street, Hill End, S. Brisbane.
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Miles, Hon. E. D., M.L.C., Ascot, Brisbane.
Mobsby, H. W., F.R.S.A., Hon. Lanternist, Department of Agricultural and Stock, William Street, Brisbane.
Moore, Dr. J. I., Commissioner for Public Health, Brisbane, or Wynnum.
Moran, H. S. F., Dental Surgeon, A.M.P. Buildings, Brisbane.
Morgan, Dr. T. H., "Milford," Wickham Terrace, Brisbane.
Moreton, The Hon. B. B., M.L.C., "Waratah," Maryborough, Q.
Morris, Rev. W. F. P., M.A., "Hurlton," Chelmer, Brisbane.
Moss, R. D., Messrs. Dalgety and Co., Elizabeth Street, Brisbane.
Mottershead, A., B.A., B.Sc., Church of England Grammar School, Brisbane.
Munro, J. H., J.P., "Ness Bank," Toowoomba.
Murphy, The Hon. Peter, M.L.C., Hamilton, Brisbane.
Murray, His Excellency, Hon. J. H. P., C.M.G., Lieut.-Governor, Port Moresby, Papua.

Nally, P. J., Intelligence and Tourist Bureau, Brisbane, Q.
Needham, F. H., J.P., 37 Marlborough Street, Drummoyne, Sydney, N.S.W.
Nicholas, C. E., J.P., "Highlands," Samford, Queensland.

O'Hara, R. E., J.P., New Park, Ballymoch, County Sligo, Ireland.
O'Reilly, Charles, J.P., Dornoch Terrace, South Brisbane.

Paine, A. A., J.P., "Illalong," Brandon, *via* Townsville, Queensland.
Parker, William Richard, L.D.S., Eng., dentist, Edward Street, Brisbane
Parkinson, F. C., Elizabeth Street, Brisbane.
Paul, G. W. F., M.D., Main Street, East Brisbane.
Paull, S. P., Queensland Novelty Company, Elizabeth Street, Brisbane.

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Peart, John, C.E., M.I. Mech. E. (Lon.), Engineer for Water Supply, Metropolitan Water and Sewerage Board, Brisbane.

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Tryon, Henry, Government Entomologist and Vegetable Pathologist, Department of Agriculture and Stock, Brisbane.

Tubbs. Professor H. A. Talbot, Selbourne Chambers, 158 Adelaide Street, Brisbane.

Tubbs, H. I., "Burnham," Cleveland Road, Galloway's Hill, East Brisbane.

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Walsh, J. A., Messrs. Fitzgerald and Walsh, Queen Street, Brisbane.

Waring, E. H., St. Lucia Road, Toowong, Brisbane.

Watts, J., J.P., Corinda, near Brisbane.

Watts, J. L., Taringa, near Brisbane.

*Weedon, W., Selby House, Wickham Terrace, Brisbane.

*Weedon, H. S., C.E., L.S., Box 44, G.P.O., Sydney, N.S.W.

†Whatmore, G. W., Director and Manager, Queensland Motor Agency, Adelaide Street, Brisbane.

*Whittingham, Hon. Arthur Herbert, M.L.C., "Mayfield," Hamilton, Brisbane.

†Wilkinson, L. A., Chemist, Queen and George Streets, Brisbane.

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Wilson, W. A., J.P., Flinders Parade, Sandgate.

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P3 H. R. Mill, LL.D., D.Sc., F.R.S.E., F.R.G.S., F.R.S.G.S., Director, British Rainfall Organisation, 62 Camden Square, London, N.W., England.

Dr. Eric Mjöberg, Academy of Sciences, Stockholm, Sweden.

Rev. Dr. E. F. Pigot, S.J. Science Master and Director of the Observatory Riverview College, Sydney, N.S.W.

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The Mining Industry of Queensland.*

By The Hon. Alfred J. Jones, M.L.C., Minister for Mines.

Your Excellency, Ladies, and Gentlemen,—

The subject of my address this evening is the "Mining Industry of Queensland," and in addressing you I wish to preface my remarks by saying that I do so with not a little diffidence, as I fully recognise the importance of the subject, the difficulties in condensing the matter to the necessary limit of time, and in doing justice to what I believe to be an industry full of immediate possibilities and capable of great expansion. It is not an easy matter to grasp the potentialities of our Queensland mineral resources, so vast is the area over which minerals abound and so many are the deposits of minerals in their great variety and richness. Therefore, in claiming your indulgence, I would ask you to be lenient with me if my address is faulty and my arguments are weak, but credit me with good intentions, as I desire to give a greater stimulus to our mining industry by first drawing attention to our wonderful resources and then inviting the attention and criticism of others who have equally the interests of the mining industry at heart.

Never in the history of mining in the Commonwealth of Australia has the time been more opportune than the present to urge the production of certain minerals and metals; not only those required by the Imperial Government for munition making but also those required in the general advance of our industrialism. I am fortified in this opinion by a passage in your Excellency's speech delivered at the opening of Parliament last year, in which you said: "Recognising also that adequate supplies of certain metals known to abound in Queensland are needed to ensure complete victory to the Empire and its Allies, my advisers believe that they can render the Allies' cause effective help by developing to the utmost the mineral deposits within our boundaries."

Your Excellency is aware we have been urged by the Imperial authorities to encourage the production of metals to the fullest possible extent, and thus assist the cause of Great Britain; and we in Queensland feel that up to the present our efforts have been in a measure successful. Much more remains to be done, and

*Address to the Royal Geographical Society of Australasia, Queensland, on the 23rd May, 1918, His Excellency the Governor, Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S., President of the Society, presiding.

this is a task we have set ourselves for the immediate future. Queensland has played no small part in the production of rare and other industrial metals for munition making and other purposes, particularly in the production of wolfram, molybdenite, and copper, but also zinc, chrome, manganese, bismuth, antimony, arsenic, iron, coal, tin, gold, silver, lead, graphite, mica, alum, magnesite, marble, asbestos, salt, diatomaceous earth, clays for refractory and other purposes, and, last but not least, deposits containing sapphires and opals.

Wolfram and Molybdenite.

Wolfram and molybdenite are useful for many purposes, but are specially in demand for steel making. The great need for wolfram is in the production of tungsten alloys for use in the manufacture of special tool steels where high speeds and temperatures when working have no detrimental effects on their cutting qualities. This mineral is also applied to the making of metallic tungsten for incandescent lamps, its use for this purpose having enormously increased during recent years.

Molybdenite is also used in the manufacture of special steels, the demand for the latter being very great at the present time in the making of munitions. The metal can also be utilised as a substitute for platinum in many ways, and later on, it is considered, the metal will take the place of platinum for the many uses to which it is well adapted in jewellery. It is as soft as steel, quite malleable, will not tarnish, is permanent in colour and lustre, and is capable of being worked as easily and effectively as the platinum itself. A substitute for platinum has become absolutely necessary, because the Russian mines are practically idle, and nearly all the world's supplies of the metal in the past have been derived from mines in that country. Perhaps the finding of such an excellent substitute in molybdenum for jewellery purposes might permanently divert the uses of platinum for ornamentation, and should this result be brought about, we may look to a very limited market for Russian platinum after the war, and an increased demand for the Queensland molybdenite.

Compared with other metals, such as copper, the tonnage production of wolfram and molybdenite is somewhat small, but it must be understood that these metals are comparatively rare, and as a matter of fact are known within the Empire as "the rare metals." Prior to the year 1904 the quantity of wolfram produced was small, but in that year a great impetus took place in wolfram mining, the value of the production reaching

£161,635, the quantity produced being 1,538 tons. During the war period prices have become inflated, the yields in quantities and values being as follow:—

QUEENSLAND WOLFRAM PRODUCTION—1914 TO 1917.

Year.	Tons.	Value, £.
1914	240·9	21,764
1915	416·2	54,300
1916	370	57,813
1917	352·7	58,367
Four years' totals	1,379·8	192,244

Queensland produces, in the aggregate, more wolfram than all the other States of the Commonwealth, and, with the exception of a very small quantity, the yields come from North Queensland and chiefly from the Chillagoe District.

Regarding molybdenite, we are by far the largest producers in the world, and it is a fact that our output of this mineral is nearly twice as much as that of all other countries put together, the next largest producers being New South Wales and Norway.

In the war years the quantities produced, with their values, are as follow:—

QUEENSLAND MOLYBDENITE PRODUCTION—1914 TO 1917.

Year.	Tons.	Value, £.
1914	270·8	53,509
1915	344	71,063
1916	217·8	53,438
1917	242·5	69,790
Four years' totals	1,075·1	247,800

A word or two regarding prices may not be out of place here. The market for wolfram and molybdenite before the war was speculative, and fluctuated considerably owing to manipulations by German firms in their own interests. After the outbreak of war, the Minister of Munitions in Great Britain took control of the supplies of wolfram, scheelite, and molybdenite, and fixed a standard price. The pre-war price of wolfram over 1914 fluctuated between 28s. 6d. and 34s. per unit. The present Australian price at place of production, as fixed by the Commonwealth Government at the instigation of the Imperial Government, is £2 12s. 6d. per unit, or £262 10s. per ton, which is practically double the pre-war price. Likewise, the price of molybdenite has doubled, the Australian fixed price at place of production being 105s. per unit, or £525 per ton.

While this is the highest price ever paid in Australia for molybdenite, the American price is slightly over £1,100 per ton. Owing to the great difference in the two prices, an agitation has

started in New South Wales for an increase, ostensibly for the reason that it will enable them to work their lower grade propositions. We in Queensland have been asked to join in the agitation, but while it is desirable and just to secure for the metal producer the best possible price under normal conditions, it may be considered unfitting for this State, which is the largest producer of rare metals, to ask an abnormally high price for the article—a price that cannot possibly be permanent. We know that the destination of the molybdenite is Great Britain, and that every ounce produced here is used for munition making, and we also realise that it is of no small assistance to the Empire in her hour of need, so that it is questionable whether we should raise a complaint as regards price just now.

Apart from that aspect of the question, it would be a short-sighted policy to attempt to establish this branch of the mining industry on a price much inflated. There has been not a little controversy between the Federal Government and ourselves regarding the exportation of these rare metals and the agency charges, but our complaints were not so much as regards prices as the extra cost of handling, sampling, and assaying under the private agency system. For example, it cost the Queensland producer no less a sum than £18,000 to place 513 tons of metal in the hands of the Imperial Government. Our contention was, and is, that if the State Governments acted as agents for the Commonwealth Government (which Government has the control of these metals) we could eliminate the extra cost of handling and the commission charges, because we have all the facilities for treatment, sampling, and assaying at the place of production. Under the present system, the ore, after sampling, is shipped from Cairns to Sydney and is re-sampled, which we consider is unnecessary. As far as the producers are concerned, our agitation resulted in a benefit to them, because they are now paid the fixed price at the place of production, and the extra cost of handling is simply transferred to the Imperial Government. This arrangement is not exactly what we desired in Queensland, and another scheme was devised by the Federal Government whereby an agency was established in this State. It remains to be seen, however, whether the change instituted will be all that is desired or even as satisfactory as the old arrangement. In my opinion, the State Government should act as direct agents for the Commonwealth, and no commission charges should be made. We have all the facilities required, and if it is proper for the Commonwealth Government to act on behalf of the Imperial Government, then surely our suggestion to act on behalf

of the Commonwealth Government is not an improper one. The prices paid for these metals are good, and we cannot urge too strongly the necessity of the miners continuing to increase their production, as we ourselves are urged to action by the Imperial Government. Our Government battery for treating the ore is working full time, crushing molybdenite and wolfram, and we confidently hope that this year's production will eclipse all previous returns.

Copper.

Queensland is noted as being the premier copper-producing State of the Commonwealth, and bids fair to retain her position in this respect when we consider the prospects which are opening up in various mining districts. Last year (1917) and the year previous (1916) we produced, respectively, 19,062 tons and 19,519 tons of refined copper, which represents more than one-half of Australia's output for these two years.

The principal copper-mining centres are Cloncurry and Mount Morgan, while other important deposits occur at Glassford Creek, Cannindah, Kilkivan, Herberton, and Mount Perry.

In the Cloncurry district copper-bearing country has an area of about 250 miles by 40 miles. The potentialities of this district are indeed great, and the opinion has been expressed by competent authorities that it will become one of the leading copper-producing areas of the world. The low-grade ore deposits of this district are of great extent, and are practically untouched and await development.

We know that in the United States of America companies treat low-grade copper deposits having grades of ore varying from 1·3 to 1·87 per cent., and many thousands of tons of ore are treated daily by the Utah, Ray Consolidated, Nevada Consolidated, Chimo, Calumet and Hecla, Miami, Anaconda, and the Inspiration Consolidated Copper Companies; and it is the result of the treatment of these low-grade ores which makes American responsible for 60 per cent. of the world's output of this metal. In Queensland the Mount Oxide Mine, in the Cloncurry district, has produced altogether 3,241 tons of metal, the ore treated having the high average of about 40 per cent. All of this was obtained from a large lode under locally favourable conditions, but notwithstanding its high percentage, the treatment was found to be unprofitable. Various reasons can be adduced to account for this condition of affairs, but primarily it is due to the isolated position of the mines, the cost of fuel, and the high transport and treatment charges. It may also be

stated that the Empress Mine at Herberton, which sends its high-grade ore to the Port Kembla Works in New South Wales, refrains from treating ore containing only 9 per cent. of copper, this material having to be dumped to await more favourable conditions, such as would be brought about by the establishment of local smelting works. One of the great drawbacks of Queensland is in not having an electrolytic copper refining works established in the North, where most of the copper is produced. As with other industrial metals, the war is responsible for the prevailing high price of copper, and no doubt the price will not decrease while it is prevailing, and probably for some years after. This opinion is verified by those who have made a study of the question in this and other copper-producing countries.

By Commonwealth enactment and under the War Precautions Act, it is decreed that all copper leaving Australia must be refined. While it should be the policy of the Australian people to establish their own works for the refining of their own metals, and applying them to local requirements, during the period of the war it might be advisable, in view of copper being so much required at the present time, to allow consignments to be made direct from the nearest port of the producing centre, these consignments to consist of copper matte, blister copper, high-grade ore, concentrates, or any other material profitable and expeditious to forward. In normal times we should encourage the manufacture of our own metals, for too long have we in Australia been sending away products which should be treated in our own country. For instance, we are now electrolytically treating copper at Port Kembla in New South Wales, and yet we send the refined metal to the other side of the world for the simple process of rolling it into sheets and drawing it into wire.

With the exception of iron, probably copper is the most important industrial metal, and we should give every weight to propositions which have in view the development of the deposits of this useful metal in our State.

Coal and Coke.

A country which runs its own railways should develop its coal resources. In this direction this State is now developing the coal measures at Bowen, Styx River, Dawson Valley, and Warra. The Bowen Coal Field is situated in the hinterland of the Port of Bowen, and contains enormous quantities of valuable coal. The bores which have been put down by the State, and also by private companies, show that quite a large

number of seams exist, and the quality of the coal is almost all that could be desired. The State has caused a number of bores to be sunk in an area which is reserved for State purposes, a railway to which is now under construction.

The Dawson Valley coal measures where they have been opened up are situated in an unfavourable position with regard to river flood, and this fact has unfortunately retarded the operations of opening up the seams known to be of good quality. The Warra coal area has been opened up, while at the Styx River the coal measures have been prospected by bores. On the latter field the coal is of splendid quality, but the seams appear to vary in thickness. At Blair Athol, in Central Queensland, there are enormous quantities of coal, and it is claimed that this field possesses the largest coal seam in the world, its thickness being 91 ft. The utilisation of this great deposit is a problem to solve, and many are the suggestions that have been made to convert all this carbon into energy and distribute it electrically to places where power is required.

Ipswich and Burrum both produce classes of coal suitable for the manufacture of metallurgical coke, and areas remain unworked in these localities awaiting the installation of coke ovens in which to make a high-class coke and save all the valuable by-products which they are known to contain. It is estimated that by-products to the value of 14s. 8d. per ton of coke produced could be saved by the introduction of more modern methods of coke-making. As a nation we are wasteful; our Governments are wasteful, our smelters and factories are wasteful, our mines are wasteful, and our transport systems are wasteful. As a matter of fact, there is waste everywhere, but the greatest waste taking place in the mining industry is in the manufacture of coke under the obsolete beehive oven system. The air is polluted with fumes from these ovens which could be converted into use, and our attention should be directed towards the conservation of this waste and to the removal of such a nuisance. In certain States in America it has been enacted that coke shall not be manufactured unless the valuable by-products are saved to the nation, and similar conditions should be insisted upon here.

Iron.

The greatness of any country depends largely upon the development of its natural resources, and as Queensland has wonderful mineral resources for future exploitation it should become great simply as a result of the development of these resources. Our deposits of iron are extensive but undeveloped,

and the State is now investigating the possibilities in this respect with a view to the establishment of iron and steel works.

Probably the most attention has been paid to the Mount Biggenden magnetite deposit, which has been estimated to contain 500,000 tons of high-grade ore, situated within easy distance of railway and seaboard, with bodies of good fluxing material adjacent to it and all material quite easy to mine.

The high grade of the Biggenden ore is seen from the following analyses:—

Biggenden Ore Analyses.

	* %	† %
Iron	61·8	67·8
Lime	3·3	0·5
Silica	5·6	2·0
Magnesia	0·4	0·1
Phosphorus	0·06	0·02
Sulphur	0·04	0·3
Bismuth	0·17	0·05

* Broken ore. † Sand from magnetic separators.

Small quantities of this ore have been smelted at Monteith's foundry at South Brisbane, Hockley's foundry at Maryborough, and at the railway workshops at Ipswich. The following analyses have been made of the pig iron produced at Monteith's and at Ipswich:—

Analyses of Biggenden Pig Iron.

	* %	* %	† %
Graphite Carbon	2·41	2·38	0·77
Combined Carbon	0·91	0·86	1·89
(Total Carbon)	3·32	3·24	2·66
Silicon	1·2	1·1	0·14
Manganese..	0·35	0·30	trace
Phosphorus	0·60	0·50	0·03
Sulphur	0·10	0·6	0·11
Metallic Iron (by difference) ..	94·43	94·8	97·06

* Smelted at Monteith's Foundry South Brisbane.
† Smelted at Railway Workshops, Ipswich.

The possibilities of establishing the iron and steel industry in Queensland will depend upon the economical assemblage of the necessary material, and Queensland possesses the iron ore, limestone, manganese, fuel, and all accessories required to produce the best class of iron and steel.

At Newcastle, where the Broken Hill Proprietary Company has established a large works, all the ore is obtained from Iron Knob, in South Australia, from which place it is railed 36 miles to the seaboard, and thence shipped to Newcastle, the limestone being brought to the works from many miles inland in New South Wales and the manganese from our own State, the fuel, of course,

being obtained from the mines in the vicinity. In Queensland, on the other hand, we have several centres where all the material could be assembled, some within a radius of 50 miles of the ore and fluxes, and it will be our endeavour to accumulate all the data bearing on these possible centres of production with a view of determining the best site in which to establish treatment works.

Gold.

No doubt the most dismal part of this address is the admissible fact that since the year 1903 there has been a marked and rapid decline in our gold production. During the year 1903 Queensland produced 668,546 fine oz. of gold, and since that time the yield declined year after year until in 1917 we produced only 179,305 fine oz. Only in one year (1883) since 1878, when the production for the year was 173,460 fine oz., has our gold yield been so low. This is due chiefly to the gold decline of Charters Towers, Gympie, and Mount Morgan. The decline cannot be better illustrated than by comparing last year's yield from our principal gold fields with the respective best years:—

Goldfields and their Most Productive and Least Productive Years.

Field.	Most Productive.		Least Productive.	
	Year.	Oz.	Year.	Oz.
Charters Towers	1900	283,237	1917	30.784
Gympie	1903	147,622	1917	33,359
Mount Morgan	1889	314,356	1917	93,589
Coen	1905	6,894	1917	110
Eidsvold	1889	13,310	1917	Nil
Etheridge	1896	16,548	1917	7,109
Palmer	1880	61,617	1917	577
Croydon	1900	48,015	1917	1,491
Hamilton	1900	8,300	1917	277

Chillagoe, which now includes the Hodgkinson, is the only field which shows an increase for the year 1917, the yield being 3,626 oz., which is a steady increase from 1913, when the field yielded only 631 oz.

Many fields in Queensland have closed down because no provision had been made in their prosperous days for developmental purposes.

Probably Eidsvold, Paradise, and Mount Steadman are fields which would still be yielding gold if more attention had been paid to developmental work and less share speculation had been indulged in. Many of the reefs on these fields are well known to be payable, but as every ounce of gold produced over and above the actual working expenses was declared in dividends, absolutely

no provision was made for the future, and the inevitable closure happened. It would be wise to pass legislation compelling all dividend-paying mines to set aside portion of profits to be used for exploitation purposes if necessary, or, if it is satisfactorily proved the mine has "duffered out," that fund should be distributed among the incoming or last shareholders, many of whom buy into mines when they are on the decline.

Arsenic.

This mineral abounds on most of our mineral-bearing fields, but, so far as investigations have shown, it is principally found at Jibbinbar near Stanthorpe, and at Calliope near Gladstone. In both localities deposits are known which are of large extent and could be worked very effectively for the mining of mispickel, the natural arsenical sulphide of iron, from which most of the arsenic of commerce is made. In Northern Queensland extensive lodes of arsenical ores are said to exist, but up to the present little is known officially as to their extent or value.

For industrial purposes the ores are roasted for the production of an oxide of arsenic known as "white arsenic," a poison required in the manufacture of compounds for prickly-pear destruction, for glass-making, and for sheep and cattle dips, this oxide also being used for a great variety of other purposes, such as in dyeing, fireworks, medicine, and insecticides.

The great demand for arsenic at present is due to the requirements of the manufacturers of prickly-pear poison, and the State has felt the necessity of undertaking the development of some of the arsenic lodes at Jibbinbar, and now contemplates the establishment of works for roasting the sulphide and producing grey and white arsenic on a commercial scale.

Asbestos.

The demand for this valuable mineral has been accentuated in recent years because of its increasing usefulness in building construction, and because the war has stopped supplies from reaching us from Canada, where the greatest asbestos mines of the world are located. The mineral fibre is mixed with Portland cement, and pressed into large sheets for wall linings and into the form of slates for roofing, these productions fast taking the place of wood and iron. It is also used in many other ways, such as in steam-packings and boiler-coverings and in flooring compositions, so that the finding of good asbestos deposits in this State would be very desirable from an economic point of view.

The deposits which have been discovered here are identical in character with those of Canada, and while we have not yet

found all that we desire in the way of a high-grade asbestos, nevertheless there are possibilities of such discoveries being made about Kilkivan, Cawarral, Marlborough, and Bowen, where the mineral has been found and worked to some extent and prospecting operations in some of the places are now in progress. The product of the mines about Cawarral and Marlborough are in demand just now for the manufacture of floorings and wall-lining, and if sufficient can be produced and the prices are moderate there is a probability that it will be used extensively in place of wood and earthenware tiles in the better class of house decoration.

With the prevailing prices of asbestos fibre, the mining of deposits would certainly pay very well, and, if we could establish an industry in Queensland at the present time, there would be no question about its permanence when trade conditions after the war became normal.

Terra-Cotta Clays.

Terra-cotta clays for making roofing tiles are much in demand just now, primarily because iron sheets are difficult to obtain and the cost is much above that of pre-war times. The colour effects of the tiles on the roofs are very attractive, and the coolness of houses covered with them appeals specially to us in Queensland with our long summer. Those in the trade are of opinion that the present demand is likely to continue after the war, and that now the public has taken a fancy to roofs of terra-cotta never again will there be the same demand for galvanised iron for this purpose in our cities and towns.

Consequently manufacturers are on the lookout for terra-cotta clays, and Southern operators are investigating the possibilities of our deposits, with a view of opening up extensive works for the making of tiles. About Brisbane and its suburbs these clays abound in small quantities, but large deposits remain untouched about the Pine River and in other adjacent areas.

Mica.

Useful deposits of mica have not yet been developed in Queensland, and in our eastern mineral belt there do not appear to be any prospects of discovering it; but to the west of Cloncurry, at Rifle Creek, an extensive belt of muscovite has been found and only waits development. The sheets which have been obtained from the outcrop are all that could be expected, both in size and quality, and some action should be taken to open up such a promising show. The prices of mica vary considerably with the quality and size, and from a few pence per pound it

ranges up to 30s. per lb., and these Rifle Creek deposits, even if only a small percentage of the mica proved useful, should be an attractive proposition to the mining operator.

Other Minerals.

Mention might be made of many other minerals to be found in Queensland, but short reference can only be made to a few of them, specimens of which are placed before you this evening.

Manganese abounds in the Gladstone and other districts, and at the present time quantities are being used for the manufacture of steel at Newcastle. The quality is not so high as that obtained from some of the European centres, but nevertheless the demand is on the increase.

Chromite is also being mined in the Rockhampton district from the serpentine country at Cawarral and Kunwarrara. This is being used in connection with smelting operations, not so much for the manufacture of steel, but for the making of fire-brick linings for smelting furnaces, and the Queensland product has been found suitable for this purpose.

Magnesite is another mineral used as a refractory substance in connection with smelting operations, and deposits of this important mineral also occur in the Serpentine country in the Rockhampton district. Another use for this mineral is in connection with the manufacture of a flooring composition, the mineral being burned like lime and mixed with other ingredients to make very effective floorings and wall linings.

Graphite.—A noteworthy occurrence of this mineral is at Mount Bauple in the Wide Bay district, and the lead pencils shown here this evening have been made from material derived from this deposit. Small graphite crucibles have also been made from it, and the experiments have been considered successful. Stove polish, foundry facings, and paint have also been made from it, and with a little fostering the mining of graphite and the manufacture of graphite products should develop into a commercial enterprise.

Antimony occurs in a number of localities in the State and has been worked both for itself and in conjunction with gold. Neerdie, St. John's Creek, and Northcote are noted localities where this mineral abounds, but it does not appear to be profitable to work unless the gold which it usually contains can be extracted as a by-product.

Marble.—Queensland is very prolific in limestones, and in some areas the belts of this mineral have been changed to

crystalline marble. The coloured marbles of Calliope and Marblestone are well known, also those of Hunter Island and Marmor, but the limestone deposits of Ulam recently examined have revealed the presence of beds of a beautiful white stone. Quarrying operations are now in progress, and it is estimated that immense quantities are available for all classes of ornamental work for which white marble is adapted.

Time will not permit my talking about other minerals. I should like to have mentioned something about bismuth, diatomaceous earth, salt, fire clays, china clays, building and ornamental stone, sapphires, opals, and minerals for pigment making such as ochres and barytes.

In conclusion, it seems to me that the development of all these minerals will depend upon the establishment of up-to-date metallurgical works in this State, in preference to having them forwarded for treatment to the Southern part of the Commonwealth. When we consider that Queensland has a greater variety of minerals than any other State in the Commonwealth, and has such vast areas of mineral-bearing country to be explored and developed, and also facilities for the establishment of treatment works, and, might I add, a sympathetic administration, there is every reason to hope that the future of its mining industry is indeed bright. Further it may be advisable to consider the formation of prospecting parties under the direct control of a geologist who would select areas where operations should be conducted, and who would personally examine all the deposits discovered by miners and prospectors under his charge; and by operating in that way we would save some wasted energy and money which takes place under our present unsystematic method of prospecting this State, while at the same time there would be very little chance of missing deposits of minerals usually unknown to the ordinary prospector.

Might I also add, finally, that as the present administrative head of the Mines Department I am of opinion that the condition of the mining industry of Queensland and the future prospects which I have outlined warrant closer attention being given to the study of our mineral development and treatment, and that I would like to see brought about a conference of departmental officers from different parts of the State, private mining engineers and metallurgists, and others closely interested in the industry to discuss the many problems which are now confronting us.

Your Excellency, ladies, and gentlemen, I thank you for the attention with which you have listened to my remarks, and I hope my somewhat rambling address this evening will do some little towards improving an industry that I have so much at heart.

In moving the vote of thanks to the lecturer, whom he characterised as a "live Minister," Alderman J. W. Hetherington fully agreed with Mr. Jones's suggestion for a Mining Conference. Queensland was enormously rich in minerals, its coal deposits being practically inexhaustible, and the Minister would be rendering incalculable services to the country by encouraging the development of its mineral resources to the fullest extent.

Captain G. A. Richard, in seconding the motion, said he believed the lecturer was the first Minister for Mines who had "come out into the open," and hoped Mr. Jones would follow up his very valuable lecture with other lectures on similar lines. The Geographical Society was the proper channel through which such subjects as concern the vast resources of Queensland should be communicated to the world, and the lecturer had acquitted himself most worthily.

His Excellency the President, in putting the motion, which was carried by acclamation, also expressed hearty approval of the precedent established by Mr. Jones, and characterised the lecture as being of great interest and importance. Nothing, he was sure, could contribute more to the welfare and prosperity of the State than the rapid development of its immense resources.

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ANNIVERSARY ADDRESS TO THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA (QUEENSLAND).*

By His Excellency the Rt. Hon. Sir Ronald C. Munro-Ferguson, P.C., G.C.M.G., LL.D., Etc. (Patron).

If any race should know its geography it is ours, with its "many mansions" in all parts of the world, its splendid honour roll of hardy mariners and explorers, and its need as a great trading community to have a thorough knowledge of the physical features of the coasts and harbours of every country by which new markets can be reached.

It is therefore most satisfactory to find the Geographical Society of Australasia firmly established throughout the Commonwealth, and it is a genuine pleasure to me to address this most active branch, and to congratulate it on what it has accomplished both within this State and outside of it. You have done work for which the Commonwealth is grateful, and I have no doubt our many Governments entertain lively anticipations of further good service yet to be given.

We have been the greatest map-makers of the world. It is still Great Britain that surveys and charts every sea and coast-line, as the presence of an Admiralty survey ship now at Port Stephens reminds us, but as geography, like every other science, is not static, study and research must be carried on unceasingly by every generation, so that the knowledge of to-day may open up all the hidden things to which this line of inquiry can give access.

Recognising this, leading men in the community, like the late Sir William MacGregor and Sir Hamilton Goold-Adams (whose

* Delivered at the Annual General Meeting, 24th August, 1920.

passing away we all deeply regret), closely identified themselves with your work, and you have been fortunate in securing the intelligent support of other leading citizens. Among them the late Sir Samuel Griffith, distinguished in so many walks of life and one of the great men of the greatest period in Australian history, has been one of your Presidents and one of your most effective and strongest supporters. The late Sir Thomas McIlwraith, and the late Mr. Tom Petrie, who inspired that illuminating work on the aboriginals, were also members of your Society.

Our leading men recognise that the pursuit of natural science is the order of the day, and that the scientist is the "Deus ex machina" who steps down from the laboratory and solves our problems, puts new machines into our hand, extends our spheres of activity, and raises our standard of health. All the same, few people perhaps realise what a wealth-producing factor the modern scientist has become. It is he who has added most to the riches and the capital of the world by his innumerable discoveries, which have quadrupled production, harnessed fresh forces of Nature to the service of man, and at the same time transferred the heavier part of Adam's curse from man to machines. It is to the scientist we look at this moment to tackle the tick; also that vegetable "bushranger" the prickly-pear, and transform it into profitable fodder or reduce it to a valuable chemical. It is he who will show us how to turn our wasted timbers into paper. In fact, the scientist is the King Midas of modern times—everything he touches turns to gold—and it would be difficult to estimate the amount of material wealth which is the direct outcome of the travail of his brains. In spite of this he is often looked upon with suspicion and regarded rather as an outsider segregated from the toil and practical problems of the day; whereas as a matter of fact almost every advance in production originates with him, and his intervention can at any time revolutionise the methods of industry and add millions to our wealth.

Societies such as yours can do much to stimulate intelligent interest in scientific subjects by disseminating knowledge through all the various channels by which it percolates to the public, so that at any rate the rising generation may understand the value of scientific research and be ready to support it with whole-hearted enthusiasm.

Your admirable Journals, extending over a generation, supply a fund of knowledge, and are an invaluable record of experience and research.

Discovery and science came to Australia hand in hand. Our earliest records are those written by scientific men equipped with knowledge, and the recital of the names of those early investigators —Dampier, Cook, Flinders, Banks, Hooker, Franklin, and Darwin —is to give a list of the foremost scientists of their own day. Cook, Flinders, and Bass, who crossed the seas in crazy vessels and surveyed our coasts in open boats, came here thirsting for exact knowledge, and added continents and islands to the British Empire while prosecuting a search after new flora and fauna and while striving to make correct charts of the Southern Seas. And, as so often happens, to those who seek not it is given; Captain Cook found not only new botanical specimens but a new continent—a realm of gold, golden sunshine, golden grain, and golden metal— and added it to the possessions of his country.

It took five hundred years to discover and chart the physical features of the New World. Dampier forestalled Cook by a century and landed on our north-west coast, but his interesting journals show that he was not favourably impressed by the country and turned his back upon it. It was therefore Captain Cook who blocked in the main outline of the "missing" continent, and opened up some of the fairest lands of the Southern Seas to British occupation. But he did so while on a scientific mission. He had been ordered to the Pacific to observe the transit of Venus, and fortunately his business with the heavens did not prevent his keeping his eye on Mother Earth. Venus did not wholly monopolise his attention, and, in the intervals of star-gazing, he discovered Australia, New Zealand, and a series of minor islands.

The records of these great scientific navigators have been lost or mutilated, and we know too little of their achievements or of the great French seamen who co-operated with them even during the long Napoleonic wars, thus proving once more the international and conciliating power of science.

Among the notable logs that escaped destruction was Captain Cook's, with its interesting descriptions of these lands, their inhabitants and natural features, and of his own adventures on the Barrier Reef, whether in what he called a "genteel gale" or when stranded on the rocks. These, together with Sir Joseph Banks's books, make a fine prologue for the records of your own Society.

One cannot read them without involuntarily speculating as to what would be the impressions of those early discoverers could they revisit the lands they threw open to the white man. They might still touch on many parts of unoccupied coast and see no changes save perhaps the absence of the forests that once clothed the country; whilst observers such as Captain Cook and Sir J. Banks might be puzzled by the gaunt, grey, ringbarked trunks of dead trees, and set about seeking for the curious destructive beasts that had worked such havoc.

Cook's wandering spirit would at any rate take comfort in finding some of his countrymen carrying on the work to which he gave his life and which is still so incomplete. Your Geographical Society deals with a great seaboard and a great landward area which present features of peculiar interest and offer a great field for your activities. Your excellent Journals record the research of over thirty years, and show how carefully you are carrying on investigations. We have a good deal of information about the north coast of Australia, from Cooktown to Broome, but much of this is still in outline, and details need to be added. Of the great hinterland little is known, and, indeed, no geographers ever had so much material at their disposal, and to none ever came such a stimulating call to effort, seeing that it is their own country they are dealing with, and thus it presents problems of great difficulty and interest, on the solving of which depends the future course of Australian history. But time presses, the populations of other lands—some of them our near neighbours—are spilling over into neighbouring countries, and it would be well, therefore, if we could speedily determine what vacant territory is fit for settlement by our own race, and discover how lands not at present fit for the white man to live and work in can be rendered healthy and suitable for the habitation of a white race.

Your Society performs yet another service by directing public attention to other countries, and thereby inculcating the habit of looking outwards as well as inwards—thus laying the foundations of that sympathy and understanding which are always forthcoming when definite information takes the place of hearsay and prejudice.

The expansion of Australia's administrative sphere and responsibilities through her acceptance of mandate has launched her on the full tide of the world's affairs; it behoves us, therefore, to make every effort to gather up and disseminate accurate knowledge of facts, so that we may have an instructed and

enlightened public opinion to guide the destinies of our own country and of the lands for which Australia is now responsible.

Mr. J. P. WILSON said:

We are much indebted to His Excellency the Governor-General for this annual Presidential Address, and on behalf of the Society I wish to express our gratitude and sense of the honour done to us by having this forenoon set apart for the purpose, as we know there are heavy calls upon the time available during His Excellency's short stay in Brisbane.

I shall not detain you many minutes in speaking of two matters which His Excellency referred to.

You were good enough, Sir, to refer in a very complimentary way to our Journal, and, as one who can claim no credit for any original matter published, I may be pardoned for saying that the Society is proud of its Journal. Many applications for copies cannot be supplied; we are continually receiving requests from foreign countries for copies of special issues and sets, showing the great interest created by the articles published.

Among the attractive papers, those contributed by our worthy and indefatigable Secretary, Dr. Thomson, were not the least important, and were among those translated and republished in foreign journals.

At this particular time it is desirable that greater publicity should be given to the essay written by Dr. Griffith Taylor, who was awarded by this Society the Thomson Gold Medal for his thesis in 1918. Dr. Taylor went thoroughly into the question of rainfall, quality of the country, and suitability for white residents, showing which parts of tropical North Australia were suitable for successful development.

Just now we are talking of and expecting an influx of suitable immigrants from Great Britain, so attention should be drawn to North Queensland with its vast unoccupied spaces and potentialities. Dr. Taylor's paper is invaluable in this connection, and should be read by all who take any interest in this subject of peopling Australia. These empty spaces must be peopled if we are to justify our occupation, not only by securing the possible wealth in pastoral and agricultural produce as well as minerals, but by being able to defend the country against invasion.

I am glad to notice from the newspapers that Dr. Griffith Taylor has been appointed to the Chair of Geography in the Sydney University, which is, I think, the first University in Australia to found a chair in connection with this important science.

His Excellency also spoke of investigations in the North Coast of this State. Our late President, Sir Hamilton Goold-Adams, had this matter very much in his mind, but owing to the War nothing could be done for the last six years. Money is required to fit out an expedition, but there have been so many calls upon the citizens up to the present that it was thought wise to wait a little longer before appealing for funds. I hope that before long we may see our way to make a start, and that a survey of some parts of the coast as well as of the Bellenden-Ker Range may be carried out. If the expense can be covered, no doubt scientists can be persuaded to undertake the work, which would, of course, include Botany, Natural History, and Geology.

I have much pleasure in moving a hearty vote of thanks to His Excellency for his stimulating address.

His Grace Archbishop Duhig, in seconding, paid a high tribute to Sir Ronald and Lady Munro Ferguson, and said the Governor-General had shown the possession of all the attributes of a great Empire ambassador. They tendered to their Excellencies an affectionate good-bye and combined good wishes for their future happiness. The motion was carried with acclamation.

The Governor-General, in reply, said it was with feelings of deep emotion and most affectionate regard that they parted from their friends in all these different centres in Australia. It would always be amongst his happiest recollections that he was enabled to meet this distinguished Society. His Excellency was then presented with the Diploma of Hon. Fellowship; and Lady Helen was presented with the Diploma of Hon. Membership.

Dr. Duhig, in proposing Lady Helen for Hon. Membership, said they had been very fortunate in having the ennobling influence of Her Ladyship for the past six years.

Lady Helen personally acknowledged the diploma, and said she was afraid this was the only learned Society to which she would ever belong, because other similar associations would scarcely consider she had the necessary qualifications. She was therefore all the more sensible of the compliment.

THE PACIFIC ISLANDS.

POLYNESIA—OCEANIA.*

By J. P. Thomson, C.B.E., LL.D., Hon. F.R.S.G.S. (Edin.),
Honorary Secretary and Treasurer, Royal Geographical Society of Australasia, Queensland, Etc., Etc.

What memories of the past do these regional place-names revive in those whose lines have been cast in the coral-girt islands of the South Pacific Ocean! They bring to the reflective mind the romantic side of life; they recall the daring exploits of adventuresome enterprise on the part of those early navigators whose romantic career has fired many a youthful breast with hopeful enthusiasm; they remind us of the illuminating pen-sketches by Louis Becke and R. L. Stevenson; they bring to our thoughts some thrilling achievements in the piratical operations of that one-time buccaneer, Captain "Bully Hayes"; they bring us face to face with primitive life in all its varied phases, ranging from the nomadic peregrinations of the native trader to the precarious existence of the beachcombers—from the reef harvesters to the tribal councillors, and from the wild head-hunters to the bush cannibals—from the excited warriors, in all their fantastic accoutrements, to the primitive village maiden, bedecked in garlands of wild flowers and habited in the simplest form of grass petticoat—from the elaborate local native court, at which the great district chieftains are represented, to the all-embracing provincial parliament of the people, where the ruling personages assemble;—all these fill us with recollections of some of the most wonderful manifestations of the stupendous forces of nature ever witnessed by the eye of man, in the modification, alteration, and creation of land forms or in local disturbances of vast magnitude, through violent earthquakes or eruptive phenomena; and they also remind us of wide devastations and great destruction to property following the wake of periodical hurricanes along the equatorial belt of this Oceanic region. All these and much more come crowding to the mind when speaking of Polynesia, the South Sea Islands, or their synonyma. While there is certainly no place on earth more beautiful, more enchanting, or more seductive to the island dweller, there are few places indeed where the forces of nature are more active, more varied, more constructive, or even more devastating.

* Royal Geographical Society of Australasia, Queensland, 14th April, 1920.

Take, for example, the coral reef phenomenon by which islands are formed and connections established on a vast scale between widely separated areas extending over thousands of miles of ocean. And be it remembered that these immense submarine and subaërial coral masses, on which the very existence and stability of most of the Polynesian Islands seem to depend, are the product of one of those low forms of animal life that enter so largely into the economy of nature and make us feel that the combined efforts of mortal man are comparatively feeble and ineffective. Surely these remarkable coral formations are among the most truly wonderful manifestations of lavish nature—mighty, far-reaching, and enduring. There is nothing grander or more sublime than to be brought face to face with this ever-progressive and ever-expanding phenomenon—this vast, restless force, by which insular land masses are formed and protected by encircling reefs, the waters of the ocean held in check, and the fury of the waves subdued. It is one of the greatest wonders of nature, placed beyond the controlling influence of man, indestructible except by its own evolutionary power, but limited in range to the tropical waters of the globe. In the Pacific Ocean it attains its greatest development, and on the Queensland coast it is strikingly represented by the Great Barrier Reef, extending for over a thousand miles along the shores to Torres Strait and far beyond. As a field for the marine biologist the Great Barrier Reef, not yet fully explored, is of wide interest and has attracted attention in most of the scientific centres of the world, alluring to its fascinating waters representatives from both hemispheres of the globe.

Then again, we find in this vast oceanic region an immense volcanic influence—a great seismic belt extending diagonally from Japan to the Peruvian coast and including New Zealand and New Guinea. In some of the island groups the volcanoes are still in a state of activity, and several years ago the Samoan Island of Savaii was for a time the scene of one of the greatest eruptions ever witnessed by any of the living inhabitants or known in local history. Most of the coralline islands of Eastern Polynesia, the groups of which extend on both sides of the equator, bear traces of former volcanic activity, as evidenced by the numerous extinct craters scattered over the land masses. That they have long been quiescent is clear from the dense vegetation everywhere covering the surface, except perhaps on the precipitous crater-rims, where the sheer walls of rock afford little encouragement to plant life.

Few people realise that the Pacific Ocean covers more than a third part of the globe, and contains within its vast periphery over half of the terrestrial water supply. The influence exercised by this immense liquid surface on the climate and conditions of life in both hemispheres must be enormous, when we consider that it is bisected by the equator and consequently exposed to the full force of the tropical sun. It is for this reason and because of the moist, equable temperature prevailing over the Polynesian region that we find in most of the Oceanic Islands great fertility of soil and a luxuriant vegetation, so that their rich natural resources afford ample provision for the inhabitants.

The early history of discovery in the "South Sea" goes away back to the days of Spanish maritime enterprise in the beginning of the sixteenth century, when the Pacific Ocean was first seen by Balboa on the 25th September, 1513. Since then there have been many remarkable developments in the affairs of Polynesia, both in the occupation of the various groups of islands and in the life of the people.

Geographically the Polynesian region is occupied by numerous groups of islands of varying extent and importance, most of which are inhabited by a variety of peoples, generally known in Australia as "kanakas" or "South Sea Islanders." Viewed in a broad and comprehensive light this Polynesian "Empire," if I may so call it, extends across the Pacific from the eastern waters of Australia and New Guinea for a hundred degrees of longitude to Easter Island. It includes the Bismarck Archipelago and Solomon Group, New Caledonia and Fiji, the New Hebrides, Samoa and Tonga, the Marshall and Caroline Islands, the Phœnix Group and Low Archipelago, Hawaii, the Gilbert and Ellice Islands, the Society and Cook Islands, with numerous clusters of islands, reefs, and lagoons scattered over wide expanses of tropical ocean and studded like gems of emerald green on the vast coral sea that eternally surges along the equatorial belt of the Great Pacific. Long regarded as the dream of early Spanish and Portuguese enterprise, these Polynesian islands are of the most vital importance to Australia and New Zealand, being placed as outposts in protecting their shores from any hostile attacks by an unfriendly power, apart from commercial considerations, whose future possibilities are unlimited and incalculable.

Many of these Pacific groups possess beautiful and secure harbours, commodious enough to shelter the largest ships of the

British Navy, and, most of them being protected by impregnable barriers of coral reef, they would afford natural protection to all classes of shipping and could be utilised as naval bases of first-rate importance. In these respects alone their value to Australia is not fully realised and could certainly not be overestimated.

Commercially the Pacific Island trade is a matter that will command world-wide attention in the affairs of national enterprise arising out of the Great War, and it now devolves upon this country to see that we are not left behind in the keen competition that is sure to take place in this matter. Profiting by her geographical position and the circumstances arising out of the war, Japan has made good use of her opportunities to occupy the Marshall Islands, over which she now holds a mandate, and in the struggle for a commercial footing in the Western Pacific she has shown herself a powerful rival to British-Australian enterprise.

In physical structure these Polynesian Islands are mostly comprised of igneous or coralline rocks with an absence of such lofty ranges as occur in New Zealand and New Guinea, with the exception of Hawaii, the Solomons, Samoa, Tahiti, and Fiji, where volcanic cones are met with ranging from 1,000 feet to nearly 14,000 feet in height. The moist south-east trade winds prevail over most of this region, the rainfall being generally high, especially in the Eastern Solomons, about Bougainville Straits, 150 inches, Hawaii 60 to 80 inches, New Caledonia over 40 inches, and Suva, Fiji, 162 inches. But on some of the low-lying atolls the moisture-laden clouds pass over without any precipitation, and consequently there are occasionally narrow rainless zones where accumulated deposits of guano occur, such as on Ocean Island and Nauru. The rainy season usually lasts from November to April. Although slightly relaxing, the climate on the whole is generally healthy, being free from zymotic and endemic diseases, but malaria occurs on the low-lying areas in the Solomon and some other large islands. There is an oceanic flora in the coralline groups, the prevailing forms being the coconut and a few other palms, the pandanus and bread-fruit trees, the edible roots being mostly represented by several varieties of the yam, the taro, and sweet potatoes. On the larger groups of islands such as Fiji, the Hawaiian Archipelago, the Solomons, and New Britain, there is a rich forest vegetation mostly common to Australia and New Guinea, although generally the Papuan plants are more distinctively Asiatic in character.

A remarkable feature of many of the Polynesian groups is the luxuriant vegetation on the south-east or windward side of

the islands, in marked contrast to the north-west or leeward side, where the forest is restricted to extremely limited patches with large reed-covered areas of wide extent, suggesting aridity and the absence of fertile soil. This is no doubt due to the fact that a larger percentage of moisture is deposited on the former, the prevailing south-east trade winds being comparatively dry by the time they reach the opposite side.

In strange contrast to their luxuriant plant life, the Pacific Islands cannot lay claim to a rich fauna except in birds, which are fairly numerous in New Caledonia, Fiji, and Hawaii. The dog and the pig have a wide range, being found everywhere within the influence of native settlement, but both have been introduced in comparatively recent times and are not natural productions of Polynesia. There are several species of rodents and some representatives of the bat family, which appear to be the only indigenous mammals of which we have any knowledge. Even insects and reptiles are by no means plentiful, being chiefly confined to small lizards, centipedes, spiders, frogs, and harmless snakes. In the Solomons the crocodile is met with both in fresh-water streams and tidal estuaries, but here this saurian reaches its easternmost limit, as it occurs nowhere else in the island groups beyond.

From this brief description of the physical and climatic conditions of the Pacific Islands it must be clear that no place could be more ideal for the abode of man than this great and enchanting Oceanic region—this seductive "Insulandia," midst reef and palm, perpetual sunshine and evergreen verdure, the dream of romantic youth, the home of early buccaneering enterprise and the scene of great human struggles in tribal warfare, when the cannibal feast was deemed a fitting celebration of victory on the field of battle.

Some attention must now be given to the autochthonous inhabitants of Oceania. Ethnologically considered they naturally belong to two distinct classes or divisions of the human family, beginning first of all with the Polynesian, comprising the Maoris, Samoans, Fijians, and Tongans, whose racial affinities are still in dispute. In physical characteristics they are round-headed, narrow-nosed, of a light-brown cafe-au-lait colour, with round orbits and black lank hair, being tall and well set-up. On the other hand, the second division, known to ethnologists as Melanesians, are long-headed, broad-nosed, of a sooty black colour, with low orbits, black frizzly hair, and comparatively short of stature. Intellectually

they are of a lower order than the former class, some being cannibals and head-hunters. In the primitive state they are savage and not infrequently treacherous, in contrast to the Polynesians, who on the other hand are altogether a superior race of people, intelligent and capable of reaching a high standard of culture, as shown by the positions they have gained at college and in the public service of the State. But even the Melanesians of the present, with the exception of those comparatively few natives living in remote and isolated inland villages, are not the same class of people as those met with in the early days of missionary enterprise, when pioneering intercourse was not always attended with freedom from danger to the white trader, recruiter of labour, or planter. Now it is an easy matter to land on any of the islands and do business with the natives, without risk of hostile attack as was too often the case formerly. The Polynesian of to-day is in point of fact a keen trader, and fully alive to the advantages of British protection.

As to the origin of these Pacific Islanders, opinions differ, it being held by some authorities that they have been allied to various races including the Aryans, the American aborigines, and the Papuans. In the writer's view there can, it is submitted, be no doubt that the islands of Polynesia were originally peopled by Phœnicians, whose migratory influence extended to the coast of Peru. This theory is strongly supported by the presence of the numerous cyclopean monuments, huge monolithic statues, paved avenues, and ramparts of walls of basaltic blocks of over thirty feet in length, brought from great distances, on Easter Island and in the Carolines. It is evident that none of the present races could erect such immense structures as these, all memory of which has long died out.

The subject is fascinating and could be further elucidated to any extent, under circumstances appropriate to its discussion.

The remarkable ruins of ancient settlement in the Caroline Islands are one of the mysteries of Polynesia and will probably never be solved. When it is considered that some of the stones forming the walls of those extensive ruins are of immense size, and are supposed to have been brought from other islands of the group across storm-tossed channels and placed in their present position with precision and masterly skill, it must be at once apparent that all this could not have been done by people similar to the present inhabitants, but must have been the handiwork of skilled craftsmen similar to the builders of the ancient ruins in

Peru and Mexico, and perhaps also Africa. Accepting this view of the matter as being reasonably sound, we may assume that Polynesia was formerly inhabited by a civilisation that has long since disappeared and become evidently extinct, leaving imperishable monuments of skilled craftsmanship on Easter Island and the Carolines—or else the islanders are a decadent people. Be this as it may, the fact remains that these ruins are a mystery to the present inhabitants of the Pacific Islands, who have no knowledge of the art of building in stone, and are ignorant of architecture apart from their own primitive dwelling-huts. This is precisely the position to-day in Polynesia, and is not of recent occurrence but has probably existed for hundreds of years before the early discovery of the islands by Spanish and Portuguese navigators, even native tradition being singularly silent on the origin of the inhabitants and their migratory movements among the island groups.

As to the fate of the original prehistoric inhabitants who left such indelible traces of a higher order of civilisation behind them as exists in the cyclopean ruins of the Carolines, we have no means of knowing, and mere conjecture can help but little. Whether they were overwhelmed by some mighty and widespread cataclysm or exterminated by epidemic disease will probably never be known. It is possible these ruins may have had their origin in some migratory wave sweeping across the Pacific from the shores of Asia to the coast of South America? Had this been the case we should expect to find some marked traces of Asiatic blood in the present inhabitants. But instead of this the dark Melanesians bear greater resemblance to the Papuans, while, next to the Patagonians, the Polynesians are the tallest people on the globe, and allied to the Maoris of New Zealand. The only feature in which they bear any resemblance to the peoples of Eastern countries is in the practice of circumcision, and this is not general but mostly confined to the Western Pacific. In point of fact there is stronger ground for assuming that the Polynesian peoples are remotely allied to the Australian aborigines on account of the ceremony of initiation of youths into the rites of manhood being practised by both. In Australia this is known as the "Bora" ceremony, and in the Fiji Group it is called the "Nanga," both having the same significance and purpose with only slight variations in the mode of procedure, as clearly established by the late Rev. Lorimer Fison in collaboration with the writer, whose investigations of the practice extended over several years.

For over a century the Oceanic peoples have been in contact with the whites, and most of them profess some form of Christianity. One of the first Christian missions to the South Seas was established at Tahiti in 1797 by the London Missionary Society, and from personal observations, coupled with perhaps a wider experience of Polynesian life than falls to the lot of most men, the writer is bound to give missionary enterprise of all denominations the highest credit for the good work accomplished in those islands.

In natural resources these Pacific Islands differ to some extent from Australia, New Zealand, and New Guinea, there being, so far as is known, an absence of great and rich mineral deposits. But the soils are extremely rich, and for the production of such important products as sugar, cotton. rubber, cocoanuts, bananas, coffee, cocoa, rice, pines, and many varieties of fruit and vegetables they are eminently suitable and probably unsurpassed. It would indeed be difficult to name any production of tropical origin that could not flourish in the fertile soils of Polynesia. But among the greatest of all the natural resources of these Oceanic territories the enormous deposits of high-grade phosphates on several of the Polynesian Islands are of prime importance. This is especially so in the case of Nauru or Pleasant Island, a small isolated spot of three square miles in area, half a degree south of the equator and rising about twenty feet above sea-level. It is estimated by Dr. Paul Hombrun to contain about 180,600,000 cubic metres (or 497,700,000 tons) of the richest phosphates to be obtained anywhere, the quantitative analysis giving from 83 to 90 per cent. of tricalcium phosphate. Although this remarkable little isle has no harbour, the phosphates are loaded into the freighters at the rate of 100 tons per hour by special contrivances. The Ocean Island high-grade phosphate deposits are estimated at 12,500,000 tons. This has been in the British possession for some time. There are also large phosphate deposits of the richest kind on the islands of Angaur in the Pelew Group, and Makatea, the estimated quantity on the latter, a French island on the Western side of the Low Archipelago, being 10,000,000 tons.

Before the outbreak of the war the Nauru and Angaur deposits —the most valuable of all—were in German hands, and would probably never have been of any advantage to Australia but for the strenuous fight put up at the Peace Conference by the Right Hon. W. M. Hughes, Prime Minister of the Commonwealth, of which something more later on. This naturally suggests some brief consideration of the political or pre-war condition of these Pacific

groups, especially in the light of their occupation by European powers and their relative position to the Australian Continent and New Zealand.

At the outbreak of war the Pacific Islands were in the possession of the United States of America, Great Britain, France, and Germany. Japan at that time having but small interests, as occupier of the Bonin Islands, a small group of about 38 square miles in extent. In the matter of territorial area and population the United States certainly ranks first in importance, the comparatively large territories of the Philippines and Hawaiian Islands, with American Samoa, giving that country premier place among the great powers interested in the Pacific. But, while this is true of our Western cousins, we must not overlook the dominant position occupied by Germany in Polynesia before she plunged the world into the awful vortex of war from which she emerged as a crushed and despised nation. The possessions formerly held by Germany in the Pacific were—Kaiser-Wilhelmsland, area 70,135 square miles, population 110,000; Bismarck Archipelago and Solomons, area 22,046 square miles, population 210,000; Caroline Islands, area 598 square miles, population 40,900; Mariana Islands, area 241 square miles, population 1,118; Marshall Islands, area 156 square miles, population 17,500; German Samoa, area 993 square miles, population 37,000.

It will thus be seen that, with widely scattered territories aggregating 94,169 square miles stretching diagonally across the Pacific from Samoa on the south-east to the Mariana Islands on the north-west, for a distance of over 3,300 miles and parallel to the seaboard of North-East Australia, Germany held the key to the Western Pacific. On each of the groups enumerated a naval base could be established and its position rendered impregnable by suitable fortifications and the natural advantages afforded by the coral-reef structures. Once this was done a hostile power could readily become masters of Australia and New Zealand, and be in a position to practically dominate the whole of the Pacific Ocean. With submarines and a fleet of destroyers it would be a simple matter to isolate Australia and New Zealand, as the enormous oil supply of Sumatra, the coal of Australia, and the inexhaustible food sources of the Pacific Islands would obviate the necessity of leaving the locality for supplies of any kind. And from such a position it would be equally effective in blocking the Panama Canal, in cutting off all communication across the Indian Ocean, invading the East Indies and the Philippines, and menacing Japan. In

point of fact there is no other region on the globe possessing such remarkable natural favourable facilities for the dominating purposes of an ambitious and aggressive power, and it is well that we have realised it in time to prevent the islands from passing into other hands.

Australians in particular are therefore indebted to the Prime Minister, Mr. Hughes, for this great Pacific heritage. In an illuminating little pamphlet of some 27 pages we are told by Mr. P. E. Deane, Secretary to the Peace Conference, what a strenuous and heroic fight the Prime Minister put up at the Peace Table—how "Mr. Hughes was called upon at a few hours' notice to present Australia's case to the Council of Ten in a small room at the French Foreign Office"; how he was "literally hurled into the room to make out a case suitable to all the circumstances which might ultimately arise"; and how he emerged triumphantly from that cold and impassive Inquisition, having "obtained for Australia, by his personal appeal alone, not only control of the islands, but a special form of mandate without which the islands would have constituted an even greater menace than before." By this mandate we now possess complete control over Germany's former Pacific territories, with the exception of Samoa, the Marshall Islands, and the phosphate deposits of Nauru, in the ownership of which lastnamed we share with Great Britain and New Zealand, the value to Australia of the phosphates alone being estimated on a commercial basis at not less than £168,000,000.

As I have already shown, the total area of the possessions formerly held by Germany in the Pacific aggregated 94,169 square miles. If we take from this the area of German Samoa, now under a New Zealand mandate, and the Marshall Islands under the mandatory control of Japan, we shall have left for Australia 93,020 square miles of some of the richest lands in the Western Pacific—lands possessing unlimited natural resources of inestimable value. Even assessed at the lowest possible estimate, as unimproved lands—which is far from being the case, large capital having been invested in their improvement—of £2 10s. per acre, the cash value is £148,832,000, which, plus our share of the Pleasant Island phosphates, makes £316,832,000 as being the fruits of our Prime Minister's mission to the Peace Conference. Do we realise the advantage of this immense heritage to the Commonwealth at large? Let the enlightened, progressive, and highly favoured people of this Continent divest themselves of all parochialism, of all political, sectarian, and class prejudices, and look at these material facts fair

and square in the face; let them do this and cast aside now and forever all class bitterness, all unworthy actions, and when the mind is purified and purged would there be found man or woman who could honestly say that the Right Hon. William Morris Hughes has not done his duty to country and Empire? As a student of science and a pioneer worker in the field of human intellectual activity I should despair of the future of the race were it otherwise. I am no hero-worshipper and have no other interests to serve outside of the glorious cause to which my active life has been devoted, but the magnitude of this transaction irresistibly impresses me and compels me to give expression to simple facts, available to all who wish to have them. And those unfamiliar with these facts should be reminded that Australia's fight at the Peace Conference would not be rendered any easier by the long-established British policy of non-expansion of the Pacific.

While realising at the Sydney Convention of 1883 that "further acquisition of dominion in the Pacific, south of the equator, would be highly detrimental to the safety and well-being of the British possessions in Australia, and injurious to the interests of the Empire," the Australian Governments were not prepared to bear the expense necessary to secure the islands, and the British authorities discouraged the acquisition of Pacific territory by disallowing the Queensland annexation of Eastern New Guinea on the 4th April, 1883. It was this mistaken policy of non-expansion in the Pacific that lost to the British Empire the Philippines, Java, Hawaii, Tahiti, and Samoa, and, but for the enlightened action of Queensland in offering in 1883 to bear the expense consequent upon the acquisition of the Papuan territory, the whole of that important country would have been annexed by Germany, and in the possession of that nation when the war broke out the position of Australia would have been rendered less secure than it was at the time.

In an address to our Society shortly after the outbreak of war, the opportunity was afforded me of visualising the position from lengthy personal experience in the Pacific and an intimate knowledge of the conditions of European occupation and settlement there. In concluding that address I said: "Strategetically the island groups of Polynesia are of great importance to the Empire, while geographically they should undoubtedly be to some extent at least under the controlling influence of the Australian Commonwealth. The dual occupation or control by an enemy power of any of these groups is a standing danger to Australia, and as great a menace to the safety and peace of the continent as the permanent German

occupation of Belgium would be to England. The south-eastern half of New Guinea should never have been partitioned, and had the late Sir Thomas McIlwraith been supported by New South Wales as he expected and should have been, Germany would not have obtained a footing in that country at all and much after-trouble would have been avoided.

Sir Thomas McIlwraith told me, with undisguised feelings of bitterness, that W. B. Dalley was to blame for New South Wales's unfriendly action in the matter.

In Samoa and the Solomons the same complicated and unsatisfactory position has existed for some considerable time, and this has no doubt arisen to a large extent through our indifference to the interests of the Empire at large, and absence of patriotism. We have gambled with our natural heritage and divided the spoils with the enemy. This is precisely the position in Polynesia, where we have admitted to partnership a race of people who have secretly undermined our influence with the object of ultimately accomplishing our overthrow, and daily entering into the keenest competition in our industrial life. In our own country they point to the oath of allegiance as guarantee of good faith, but what is this and its associated form of naturalisation to a people in the estimation of whose king the most solemn and binding treaty obligations are "mere scraps of paper"!

Having been granted the mandatory ownership and supreme control of these Pacific territories, the duty now devolves upon Australia of justifying the trust of which she has accepted the sole responsibility. If wisely and vigorously developed, it cannot be doubted they will contribute untold wealth to their owners and add enormously to the influence and importance of this great Australian Commonwealth in the Councils of the Empire and among the nations of the world. But this will never be done by haggling over the expenditure of a few thousand pounds for developmental purposes, as in the past. The task requires generous and business-like treatment, and above all a wise and humane administrative policy in dealing with the native inhabitants. To treat them as inferior, useless, and despicable races of people, as the Australian aborigines have been treated, will be a fatal mistake, and mean failure. They are in point of fact intelligent and superior in many ways, and if wisely utilised would be a most important factor in the development of our newly acquired possessions in the Pacific; indeed it is difficult to see how they could be successfully developed

without the judicious utilisation of the islanders themselves, numbering in the aggregate over 360,000 souls. For tropical agriculture they are immeasurably superior to the Indian coolies, who have become troublesome settlers in Fiji, where they supplanted the Polynesian labourers over thirty years ago. In my address to the Royal Colonial Institute, London, in 1903, this matter was emphasised; the views then expressed by me still hold good and have never been challenged; a sentence may be here quoted from the address published in the Journal of the institute, vol. 35, page 31: "In intellectual capacity the Polynesian is on a far higher plane than the Australian aboriginal; he is superior to the African negro, to many of the tribes of farther India, and is capable of reaching a high step in the ladder of civilisation." The late Sir William MacGregor, in addressing the Royal Scottish Geographical Society, 7th March, 1918, said: "It is also greatly to be desired that the nations of Europe and America may not forget that the duty devolves upon them to consider the well-being of the native races of the Pacific Islands. No truthful man can say that this duty has in the past received, as it should have done, the first consideration. It is a pity that at any convention for the settlement of the Pacific after the war, some power or powers, that has no local interests to consider, could not be appointed to represent and protect the native rights. If one is to be guided by the recent past of Africa and the Pacific, one would conclude that the interests of the native and natural owners of those fair islands will be about the last thing that will be thought of. It is all very well, as far as it goes, to respect the natural rights of small and weak nations, but it would be still better to go a step further and apply the principle to those that are still smaller and weaker—to the native inhabitants of the Pacific Islands. To those that attach but small importance to this ideal, it may be pointed out that the Pacific Islands without the Pacific Islanders would be of much less value than they are now. I know those islands well, and can assure you that from every point of view they should be preserved."

This is precisely my own view, from intimate personal knowledge of the Pacific Islanders and wider experience of the territories they inhabit than usually falls to the lot of most men. Without the islanders the islands themselves would lack much of their present value to Australia, or to any other country for that matter. Let it be hoped that the native policy so successfully carried out by the British Colonial Government in Fiji will be adopted, in so far as local circumstances may permit, by Australia in the adminis-

trative affairs of the Pacific territories now placed at her disposal. Much of the success of the future will depend on the initiation policy. A single false step at the beginning may take years to redeem, besides the evil arising from loss of prestige, which in the eyes of the natives always has a bad effect, and invariably hampers progress.

It should not be forgotten that in the Pacific Australia must reckon with the keen and powerful rivalry of Japan. The Japanese hold the Marshall Islands under the Peace Conference mandate, and are losing no time in getting a firm footing, not only there but in other groups of the Pacific, for the purpose of trade. This is the position there now, and it behoves Australia to wake up. According to Mr. Thomas J. MacMahon, who has recently returned from a visit to the South Pacific, the development of Japanese trade in the Marshall Islands and other neighbouring groups is ''most remarkable,'' the hold they have already gained being such that in five years' time British competition will be useless, the whole Pacific trade having passed into their hands. Consequent upon the investment of British capital in the establishment of large and numerous plantations for the cultivation of various tropical products of great importance, the commercial value of the Pacific Islands trade is now probably worth ten millions sterling. The lion's share of this was formerly in German hands, but since the outbreak of war the Japanese have obtained a dominant position. This is certainly a matter of much concern to Australia, whose commercial interests are of vital importance and should not have been prejudiced by alien competition at a time when the energies of the whole Empire were concentrated on the war, especially by an allied Power having unrestricted freedom in the Pacific, with plenty of ships and an unlimited supply of trade goods, both cheap and gaudy and suitable to the primitive tastes of natives and calculated to appeal to their vanity. There is a regular monthly service of steamers between Japan and the Marshall Islands, and the Japanese trade goods are being distributed amongst the islanders in all the groups of the Pacific. So it is high time Australia made a move in this matter, otherwise British influence and prestige are bound to suffer.

In the early days commercial enterprise in the South Seas was mostly limited to trading and bartering with the natives, and this to some extent is the case now. But in recent times numerous plantations have been established in Kaiser Wilhelmsland, the Solomons, New Hebrides, Samoa, the Bismarck Archipelago, and other groups for the cultivation of sugar, coconuts, rubber, coffee, cocoa, tobacco,

sisal hemp, candle nuts, and other tropical products of value. For many years the copra industry has been of great value and importance, the islands being peculiarly adapted to the growth and development of the coconut. It is perhaps one of the most profitable enterprises in Oceania, and requires but moderate experience and modest capital. The natives are expert in husking the nuts, and there is always a ready market for the copra and fibre, the latter being adapted for use in a multitude of purposes. Sugar cultivation is yet in the early stages, but there can be no doubt that in time the Pacific Islands will be among the leading producers of the Southern Hemisphere. In the natural state the sugarcane is met with in several of the island groups. For about forty years sugar cultivation in Fiji has been carried on with vigour, and the plantations extend over most of the group until now it is one of the primary industries of that Crown Colony. As far back as 1884 the Colonial Sugar Company's mill on the Rewa River was supposed to be the largest of the kind in the world. At first the labour employed in the sugar industry was recruited from the islands of Polynesia, under three years' indenture, but the Polynesians were supplanted by Indian coolies, who have become landholders and now have such a hold in the colony that they are claiming representation in the Executive Government, and have been admitted to the Legislative Council on an equal footing with the British settlers. This, of course, could never have happened had the sugar industry been carried on with Pacific Island labour, as the Polynesian loves the freedom of his own island home-life, and is ignorant of the art of peaceful penetration in lands beyond his own local environment. The "kanaka," as he is commonly called, is by nature a non-obtrusive person and not given to mischief-making or revolt, and, what is most important, he is a reliable worker and will not give trouble to his employer. The Indian coolie on the other hand is often a religious or caste maniac, and possesses the dangerous element of being cunning and crafty. As settlers in any country they are certainly not so desirable as the "kanakas," and not by any means such a good class of labourer. Nor is it necessary that the coolie should be a factor in the labour market at all, when the local supply is ample for the development of the island territories. All that is needed is the enactment of industrial laws and the control of the natives by humane restrictions that will be beneficial to themselves and their homeland.

One of the first administrative enactments should be the creation of a department for native affiairs, having as head an experienced

official in thorough sympathy with the islanders, with full knowledge of their character, and who will command their confidence and respect. If this is done and a wise system of government established, there can be no doubt that our newly acquired possessions in the Pacific will add immensely to the importance of the Australian Commonwealth and prove an acquisition of enormous value to the Empire at large. But there should be no delay in taking advantage of the vast wealth-producing natural resources of the Pacific now at the disposal of the Federal Government. In the known phosphate deposits alone there is a sure source of wealth, and it is almost certain that other islands in Polynesia will be found rich in this valuable fertilising substance. The local conditions are eminently favourable for such deposits, and it can only be a matter of time when the Pacific phosphate industry will be one of our most profitable revenue-producing assets. It is then the people will begin to realise the debt they owe to Prime Minister W. M. Hughes, whose noble fight for Australia's rights at the Peace Conference was probably one of the greatest achievements of modern times. And if to this important accession to revenue we couple the mineral wealth of Kaiser Wilhelmsland, consisting of gold and other precious metals, it will be found that our partnership with the mother country in the Great War struggle to free the world from Hunnish dominance and oppression has not been barren of results, nor was the oft-quoted rallying cry of "To the last man and the last shilling" in vain.

Now, in conclusion, it is opportune to suggest that our mandatory administration of the newly acquired Pacific territories would be very appropriately inaugurated by restoration of the original place-names of former German possessions. For instance "Kaiser Wilhelmsland" and the "Bismarck Archipelago" are names that should be eliminated at once. And as an act of justice, if not an act of grace, surely nothing could be more fitting than the substitution for the former of the name of him to whom we owe so much for its acquisition. From the geographical viewpoint it is desirable that all the place-names on our maps of New Guinea and the Pacific Islands should be uniform and of British significance. Having this in mind it is further suggested that a revisionary commission should be selected to deal with this matter, in keeping with Australian sentiment and aspirations.

THE GEOLOGY, MINERAL PROSPECTS, AND FUTURE OF NORTH QUEENSLAND.*

By Dr. H. I. Jensen.

INTRODUCTION.

The progress of geological exploration in any country invariably leads to the gradual resolution of a hotch-potch of geological formations, which on the early maps constitute a regular Chinese puzzle, into well-defined stratographical belts. So with North Queensland. Look at the geological map of the State. What can you make out of it? Is there any indication of North Queensland having been built up by that regular, almost organic, sequence of events which are indicated on such perfect geological maps as we have of Great Britain? None whatever. Still Queensland is built on as methodical lines as any part of the world, as you will readily see by my alterations of the geological map of that part of the State which I have investigated. Having had four years' experience of the geology of the Northern Territory, and one year's residence in North Queensland prior to commencing geological work there, the two years which I have now put in on North Queensland geology have enabled me to suggest some rather sweeping alterations to our map.

The old geologists—Daintree, Tenison-Woods, and Gregory—classed the metamorphic rocks of the North as Devonian or older, and for good reasons; Devonian fossils had been recognised in the Burdekin beds which appeared lithologically much newer than most of the metamorphics. These geologists paid much more attention to lithological distractions than did Jack and Rands who came after, and they were right in doing so. In fact they applied almost intuitively those petrological notions which have in comparatively recent years been established by research workers like Grübenmann. Finding highly metamorphic rocks of Permo-Carboniferous age at Gympie, and slates not unlike the Gympie slates being fairly common throughout the State, Jack, Rands, and Skertchley put all undeterminable rocks in the Gympie series, so that the Gympie became a geological scrap-heap. Since the Queensland geological department has been principally busied with economic reports on special mining fields, and very little geological survey work has

* Royal Geographical Society of Australasia, Queensland, 26th May, 1920.

been done off the coalfields and mineral fields, the geological scrap-heap has remained. The metamorphic rocks are still referred to as "probably Permo-Carboniferous" in the various North Queensland papers of our geologists; not that our geologists really believe that the rocks are Carboniferous or Permo-Carboniferous, but out of deference to Dr. Jack they do not care to alter his interpretation unless they get undisputable proof that it is wrong.

Of course certain strips of country have been removed from the scrap-heap. Dr. Jack himself suspected that the Hodgkinson rocks were Devonian. Further proof was obtained by Mr. Ball, and is recorded in his Mount Mulligan reports. Still on our most recent geological map, accompanying Mineral Index, the Hodgkinson belt is shown as "Gympie." Mr. Dunstan proved the Silurian age of the Chillagoe series in 1900; the belt of Chillagoe limestones has accordingly been given a distinctive colour on the recent maps. Otherwise the hotch-potch remains unchanged on the official maps.

You will notice on the Geological Map of North Queensland that the metamorphic rocks are largely intruded by granites and porphyries. There are also basalt areas which are late Tertiary flows. Since the metamorphic rocks were put down as Gympie, and the granites and porphyries intrude these, the igneous intrusions were naturally regarded as Post-Gympie, or at least late Permo-Carboniferous, in age. When Mr. Ball discovered proofs of the Permo-Carboniferous age of the Mulligan coal-measures it became necessary to regard the intrusives as Middle Gympie, or Lower Bowen, in age.

If these granites were really of Permo-Carboniferous (Lower Bowen) age, we may infer from the erosion which exposed them and brought them to the surface before the Mulligan beds were deposited, that the Permo-Carboniferous was a period of swift erosion. On the other hand the Mulligan beds, being themselves Permo-Carboniferous, point to this period being a period of steady sedimentation in this area. Further, erosion sufficient to expose granite cores would be the result of mountain building and folding. The Mulligan beds are but slightly disturbed. I therefore regard the granites as being at least one geological period older than the Permo-Carboniferous Mulligan beds.

The accepted view is illogical, but owing to the assumption that all the North Queensland igneous intrusives belong to this period they are all coloured the same on the geological maps of the State. Nevertheless, Ball has shown in his work on Bamford

that the porphyries of that locality are older than the granites. There is no doubt on that score. My investigations have further satisfied me that we have amongst the North Queensland igneous intrusives a number of different series of widely different geological ages. The differentiation between these is of economic as well as of scientific importance.

It now becomes necessary to outline to you the results of my own observations.

A.—THE SEDIMENTARY SEQUENCE IN THE METAMORPHICS.

The Chillagoe Series (Silurian), the Hodgkinson Series (Devonian), and the Mount Mulligan Coalbeds (Permo-Carboniferous) were landmarks to work from.

In the Featherbed Range, between Mareeba and Almaden, there is a vast accumulation of porphyry which is undoubtedly older than the associated granites. The porphyry consists of many varieties, most of which are easily recognisable. Some varieties of this porphyry occur interbeded in the Chillagoe Series, which proves a Silurian age for the eruptions. The geographic position of the porphyries between the Silurian belt and the Devonian belt is also confirmation of their Silurian age, especially as these porphyries do not intrude the Devonian Series. On the other hand, the porphyries intrude the schists, slates, and greywackes of the Herberton, Irvinebank, and Koorboora districts in great abundance. the slates and greywackes of these areas must therefore be regarded as Pre-Silurian, and I have designated them "Herbertonian," and am inclined to regard them tentatively as Ordovician in age. The Herbertonian Series is characterised by more arkose-like greywackes than the Hodgkinson Series, and by an abundance of chlorite schist-beds which are not found in the Hodgkinson rocks. The nature of the rock minerals points to the regional metamorphism of the Herbertonian Series in Grübenmann's middle zone. The series is met with south and west of the Chillagoe Series.

The Etheridge rocks have a far older facies. They are quartzites, foliated mica-schists, amphibolites, and in places even gneisses. They have been reconstructed in Grübenmann's deepest zone. On lithological grounds one is justified in regarding these to belong to an older period than the Herbertonian, and I am strongly of opinion that they should tentatively be correlated with the Pre-Cambrian (?) Cloncurry Series and with the schist series of the Northern Territory and Central Australia. The Etheridgean

Series includes most of the metamorphic rocks from the Tate River to the Gulf of Carpentaria.

The rocks between the Hodgkinson belt and the coast I have not investigated, but it is quite possible and even probable that the slates met with in the Mount Carbine and Mount Molloy districts are a repetition of the older Herbertonian Series, and that the Hodgkinson belt is a syncline. It is the rocks about Cooktown in particular which give me the impression of the geological antiquity of the formations east of the Hodgkinson belt.

B.—THE IGNEOUS ROCKS.

The age of the Featherbed Range porphyries is clearly middle or late Silurian, as streams of "porphyry" lava have become interbedded in the Silurian Series of the Walsh River.

The granites of the Chillagoe and Mareeba districts are definitely later than the Hodgkinson Series and earlier than the Mulligan Series. They are the principal mineralising agents of all the formations they intrude. The occurrence of Carboniferous *Rhacopteris*-bearing beds undisturbed by granitic action near Newellton, as recorded by Stirling, definitely places the great granitic intrusions in the early Carboniferous.

There is also a series of felsites occurring in the Chillagoe mining district which are without doubt early Permo-Carboniferous, and are contemporaneous with the tuffs and rhyolites at the base of the Mulligan Series both at Koorboora and Mount Mulligan.

We have then throughout the Chillagoe and Herberton mineral fields (in addition to the Tertiary basalts about Herberton) three ages of igneous activity—the porphyry period (Silurian), the granite period (Carboniferous), and the rhyolite epoch (early Permo-Carboniferous).

To correlate the igneous rocks of the Etheridge, or any of them, with those of the Chillagoe belt is very difficult. The typical Etheridge-Croydon granites, which cover wide areas west of the Einasleigh River, are probably Pre-Cambrian in age, or at the latest early Cambrian. But there are many localities, notably Kidston, where these have been intruded by a later granite. At Kidston the older granite has first been intruded by porphyry, which formed dykes and sills and laccolites. The Kidston Hills, Christmas Hill, and numerous other rough hill-groups south-west and north-west of Kidston, are composed composed of this porphyry. At Einasleigh, too, there are hills of red porphyry, intrusive into the older

granites, and again similar porphyries underlie the sandstones of the Newcastle Range. We also find them at the Percy. All these porphyries might best be correlated with the Silurian porphyries of the Featherbed Range. Throughout the Einasleigh we also get an ''orthophyric'' granite, associated with pegmatites and innumerable intrusions of pegmatite, even where the orthophyric granite is not seen. This granite and the pegmatite dykes mentioned are the mineralisers of the district. The age of the mineralising intrusions is probably the same as that of the Chillagoe granite, Carboniferous.

C.—UNMETAMORPHOSED SEDIMENTARIES.

The discovery of the Permo-Carboniferous age of the Mount Mulligan coal measures, which previously were regarded as desert sandstone, shows that in North Queensland there have been no earth movements of the compressional type since the Permo-Carboniferous. That there have been isostatic movements of uplift and subsidence leading to marine transgressions is evidenced by the fact, also first recorded by Mr. Ball, that there are Jurassic rocks overlying the Mulligan coal measures almost conformably—that is, there is no visible unconformability, though no doubt an unconformity exists.

The sandstones between the Walsh and the Mitchell, in the OK district, and the Laura sandstones, west of Cooktown, repeat the conditions which prevail at Mount Mulligan, and to differentiate between the Permo-Carboniferous and Mesozoic sandstones was also one of the most difficult tasks that I found in the Northern Territory, where also we had Triassic and Cretaceous transgressions depositing sandstone horizontally on horizontal Permo-Carboniferous sandstone.

The term ''Mulligan Series'' is best applied to a series commencing with Mulligan (Permo-Carboniferous) coal measures, and passing upwards into Triassic, Jurassic, and Cretaceous beds. The Borroloola sandstones (Buckalara sandstones) of the Northern Territory are typically such a series.

The Mulligan Series demonstrates the fact that North Queensland has been a ''continental area'' ever since the Permo-Carboniferous. The area is part and parcel of the Central Australian massif, which also includes the Northern Territory and most of West Australia. Marine transgressions have occurred over this area, but there has been no deep-sea sedimentation since the early Carboniferous uplift.

Central and Southern Queensland differ absolutely in geological history. They represent a geosyncline, in which moderately deep-sea sedimentation took place in Permo-Carboniferous and Mesozoic times, and in which folding movements lasted well into the early Tertiary.

D.—PALÆOGRAPHY OF NORTH QUEENSLAND.

We can now proceed to indicate what the geographic conditions were in North Queensland during bygone periods.

The Pre-Cambrian (Etheridgian) was an era of sedimentation accompanied by lava-flows, and culminating in granitic intrusions, with folding and general uplift.

The Cambrian has left no geological record in these parts, and may therefore be supposed to have been a period of mountain building and erosion of dry land.

The Ordovician (Herbertonian) was a period of steady sedimentation. There was some vulcanicity, but no violent disturbances.

The Early Silurian was a period of steady sedimentation, but extensive and violent vulcanicity took place in the middle and late Silurian. The sedimentation continued through the Devonian period, but in the early Carboniferous violent fold-movements set in accompanied by great granitic intrusions. During late Carboniferous erosion went on, and this, with intermittent transgressions in the Permo-Carboniferous, Jurassic, Upper Cretaceous (Marine), and Tertiary, has been in progress since.

North Queensland as a continental area is, however, not as old as Central and Western Australia. In the central parts of our continent even the Cambrian strata are not excessively folded. The continent grew eastwards first by the great Carboniferous uplift, which added North Queensland, and later by the Tertiary uplift, which added Central and Southern Queensland to the continental mass. The Mesozoic strata in Western Queensland and Central Australia can only be regarded as transgressions over a continental area. The very considerable thickness of almost horizontal Mesozoic rocks in the Normanby River basin, draining into Princess Charlotte Bay, points to that area being the relics of a Mesozoic Gulf of Carpentaria.

During the Jurassic and Cretaceous, North Queensland probably extended far to the east, almost to New Caledonia, much land having been lost by faulting and subsidence into the Pacific,

probably in Tertiary time. Later this "Normanby Gulf" became part of the general Australian Mediterranean in the Upper Cretaceous, if the surface rocks have not been misinterpreted as Desert Sandstone. Conditions of sedimentation were entirely like those of the Gulf of Carpentaria to-day. All the deposits were laid down in shallow water, and coal-seams were formed during periods of elevation above sea-level. Conditions of formation and also of climate were favourable to the production of oil and salt. This is one of the areas of North Queensland which deserves prospecting by bores for these valuable minerals.

E.—SUPPOSED METAMORPHIC GRANITES.

Daintree, Jack, Rands, and others regarded the beds of granite which occur after the maner of interbedded strata in the Etheridge district as altered sediments. Rands further regarded large areas of Croydon granite as "Metamorphic," formed from sediments. Dunstan has advanced the same theory in regard to the granites with *lit par lit* arrangement in the sedimentaries of the Cloncurry district. I strongly concur with Cameron and Marks that these granites are true dykes and sills in the Etheridge district. The supposed metamorphic granites of Croydon I have examined microscopically, and I can find no support for the metamorphic theory of origin.

I regard these granites as "*stocks*" injected while the sedimentaries were covered by thousands of feet of sediments. The region was eroded, again sedimented, and lowered into the zone of plasticity subsequent to these injections, hence the gradation observed at times between the intrusive rock and the intruded beds.

The Cloncurry Series I have regarded as Pre-Cambrian from analogy with the Territory metalliferous rocks, and the Camooweal limestones I, personally, am inclined to regard as predominantly Cambrian, with disconnected later deposits resting on them from analogy with the Barkly Tableland Series.

F.—ARTESIAN SPRINGS.

The escape of water by springs into the Gregory, which Mr. Dunstan has called attention to in Q.G.S. Pub. 265, is a phenomenon observed right along the eastern edge of the Barkly Tableland. Water from the limestones escapes at various points into the coastal rivers. The phenomenon is certainly indicative of an escape of artesian or sub-artesian water, but might it not be sub-artesian

out of Cambrian limestones? In the Territory we have had artesian flows out of the Permo-Carboniferous, and plenty of sub-artesian in the Cambrian.

MUDSPRINGS.—While on this subject I may call attention to several other interesting facts referred to by Mr. Dunstan—namely, the occurrence of mudsprings in the country around the Mulligan River, and the occurrence of surface salt deposits in the same region. Mr. Dunstan infers that these occurrences are indicative of an escape here of artesian water from the Barkly Tableland, the salt representing salt leached out of the Barkly Tableland limestones. There is an alternative explanation of the same facts, which would be preferred by those who believe in the Plutonic origin of artesian water, and that is, that the mound-springs are points of escape of the artesian water from the south and south-east, which from bores like Sandringham is known to be very saline. This explanation would also be supported by the angle of dip of the strata, which must exceed the slope of the country between Sandringham and Camooweal, making it impossible for Jurassic rocks to continue uninterruptedly for all that distance.

G.—THE CLONCURRY-ETHERIDGE CONNECTING RIDGE.

I regard the Cloncurry and Etheridge massifs as Pre-Cambrian until evidence to the contrary is produced. A study of the artesian bores of the Gulf country shows that a ridge of granite and metamorphic rock rises to very near the surface between Cloncurry and the Woolgar Goldfield. The water-bearing beds are struck very near the surface along this ridge, especially on Manfred Downs. The bores deepen both ways north and south from this ridge, and the flows improve, though the deepest bores on Manfred Downs having fair supplies may be taken to indicate that the connecting ridge is broken by a strait or trough fault, connecting the Burketown artesian basin with that of Central Queensland. The deep portion of the Burketown artesian basin is comparatively narrow, widening northwards from the imaginary Manfred Downs strait. It strikes north-north-west, and runs through Canobie to Burketown. The high temperatures of the artesian waters of Canobie (scalding) and many of the bores north of Richmond, the Eddington bores and some of the Fort Constantine bores, the Clutha Resumption and Compton Downs bores, are probably the effect of basic magmas, cooling igneous rocks, at a depth, intruded at the same time that the Etheridge basalts welled out over the surface at Mount Surprise and Einasleigh.

An interesting question, suggested by the occurrence of artesian water in fair quantities close to the surface at Manfred Downs and other parts along the ridge between Cloncurry and Woolgar, is whether the water-yields from these shallow depths are from the same horizon or bed as those of the deeper bores of the trough valley or not. In case they are, a folding of the artesian strata at this connecting ridge would be implied.

I do not think that there is any such fold. The water at Manfred Downs and other parts where it is tapped at shallow levels is probably from a much higher horizon than the water at, say, Canobie, but it has probably got into that higher position from the lower bed by leakage along the junction between the Pre-Cambrian ridge and the practically horizontal superimposed beds.

H.—PERIODICITY IN EARTH-MOVEMENTS.

Dr. T. G. Taylor, in his interesting paper on "Climatic Cycles and Evolution" (Geographical Review, Dec. 1919), gives a table grouping periods of mountain building and vulcanicity. The periodicity he indicates is supported by North Queensland geology up to the Carboniferous, when mountain-building ceased on the massif. There is no evidence as yet even that the Cairns coastal range has undergone any compressional movements since that period. But, taking Australia as a whole, we find that Dr. Taylor's periodicity table is amply corroborated. Where, however, I think Dr. Taylor's arguments can stand some modification is in regard to his absolute identification of the ice ages with periods of maximum vulcanicity and uplift.

It seems to me that the climatic cycles discussed by Dr. Taylor are still best explained on the carbonic acid theory, elaborated by Professor Reg. A. Daly. Vast accumulations of limestone are laid down in the periods, tranquility gradually cooling the atmosphere of the earth. For reasons as yet not understood a volcanic cycle sets in. Perhaps the rapid escape of earth heat due to the absence of the CO_2 blanket in the air is a contributory factor. The volcanic and mountain-building period results in the liberation of enormous quantities of carbonic acid through molten magmas acting on carbonate rocks. The intense igneous action going on also causes the emission of great quantities of heat which are retained in the atmosphere by the now restored blanket of carbonic acid. Hence a mountain-building period is a warm period, and warm conditions continue until mountain-building and vulcanicity cease. Then a period of continued erosion commences,

accompanied by slight oscillations. During the early part of this period of erosion the warmth of the atmosphere and hydrosphere, and the abundance of carbonic acid in the air, encourage an abundant growth of vegetation on land and an equally rich coral growth in the sea. In time the carbonic acid blanket is again locked up in the form of coal and limestone, the climate of the earth cools. Inasmuch as the locking up of the carbonic acid takes place much faster than erosion, there are high mountains left which with a cool atmosphere necesarily form glaciers and yield floating ice.

We thus get, following the period of earth movement and vulcanicity, first a period of coal and limestone (coral) production, next a cold period with glaciers descending to the sea. Lastly, as erosion levels the mountains almost to base level, we get a period of widespread aridity and red sand deposition. This continues until the next period of vulcanicity. Dr. Taylor's facts fit in as well to support this theory as the one which he enunciates. Thus, in the early Carboniferous and late Devonian period of mountain-building, uniformly warm climates and coral growth extended to the poles. This was a period of mountain-building and of intense vulcanicity.

The evidence available is entirely insufficient to show that the pre-Tertiary ice ages coincided in point of time with vulcanicity, and that they were not local, dependent on the existence of certain areas of high elevation, in conjunction with an atmosphere depleted of CO_2.

Throughout Australia the Carboniferous was an era of intense mountain-building and vulcanicity. It was followed by the so-called Permo-Carboniferous, which was a period of quiet sedimentation in most parts of Australia, and there were great deposits of limestone and coal formed in the late Carboniferous and Permo-Carboniferous. An ice age followed in the Permo-Carboniferous. During the Triassic arid conditions prevailed. A mild volcanic cycle followed in the late Jurassic. The early Cretaceous was a period of limestone formation, the late Cretaceous a period of aridity, and the early Tertiary a period of mountain-building. There should be evidence of an ice age at the close of our Rolling Downs (Marine Cretaceous) period, but as Australia had no high mountains at this time near areas of deposition, such a cool period may have occurred without leaving any geological record.*

* Since the above was written the writer has seen evidence of a Cretaceous Ice Age in the Mount Hutton district, north of Roma. The Clermont-Anakie region seems to have been the mountain area from which the floating ice came.

I.—OIL POSSIBILITIES IN NORTH QUEENSLAND.

If one tabulates the oil-producing areas of the earth's surface, and then looks on the map of the world to note their position, one realises at once that oil production is favoured by proximity to the equator.

A study of the literature on the geology of oil districts convinces one that oil is formed and preserved mainly in very gently folded sedimentary strata of estuarine origin, laid down in areas undergoing oscillation and periodically subject to desert conditions. Consequently salt-beds are commonly associated with petroliferous strata. The principal condition of the preservation of the oil in the beds is the existence of an unbroken extent of petroliferous beds in a geosyncline or trough-fault. That condition is seldom extant in the massif of the Northern Territory, but is found ideal in the Mesozoic areas of North Queensland.

Conditions are favourable in North Queensland both for the production and preservation of oil in the strata. The area which should be most favourable is the artesian area around the head of the Gulf north of the submerged metamorphic col joining the Cloncurry and Etheridge massifs; the low country east of the Gulf of Carpentaria and the mesozoic beds west of Cooktown also deserve prospecting by means of bores.

That indications of oil have already been frequently met with in our artesian basin can readily be gathered by a perusal of the artesian bore notes in Mr. Dunstan's Mineral Index.

J.—MINERAL RESOURCES OF NORTH QUEENSLAND.

Coal, Lime, and Iron are three of the most important minerals to every civilised country. They are essential to all modern art and industry.

Coal.—As far as is known at present, North Queensland is not as rich in coal as Central and Southern Queensland. The Mount Mulligan Coalfield is very small, but it is highly probable that coal-beds of Mulligan age will be found in the OK district. The Mesozoic and Permo-Carboniferous rocks behind Cooktown have been but slightly investigated. It is probable that payable coal measures will be found in this region. A coalfield also exists to the north of Richmond and Hughenden. Very little is as yet known of it.

Limestone.—Lime is most abundant in North Queensland. The rich metalliferous districts of Chillagoe and Cloncurry are plentifully supplied with high-grade limestone, which fact is of the highest value to the smelting industry. Equally important is lime

to the agricultural industry, and for pasturage lime-rich country yields the best feed.

IRON.—The principal iron lodes of Queensland are in the North. The Cloncurry, with Mount Leviathan, Mount Philip, &c., takes the lead, but the Chillagoe district has also large iron lodes which up to the present have been used mainly for fluxing purposes.

Next in importance to the above from the industrial standpoint are salt and sulphur.

SALT.—That rocksalt will eventually be discovered in our sub-artesian strata of North Queensland is quite possible. Some of the Gulf country bore waters are very saline. However, the natural conditions for the production of salt from sea-water are perhaps more favourable along the foreshores of the Gulf of Carpentaria than anywhere else in the world. The matter is the subject of a special report by my chief, Mr. B. Dunstan, which will shortly be in print, so little more need be said about it here. The importance of cheap salt to the agricultural, pastoral, chemical, and metallurgical industries makes it desirable that attention should be focussed on the development of this important industry.

SULPHUR.—Instead of the sulphur fumes from the smelting of our ores going to waste, that valuable product should be recovered from the fumes going up the stack. A portion should be turned into sulphuric acid, and the balance into flowers of sulphur. The sulphur at present going to waste at Australian smelters is sufficient to supply the entire Australian demand, which according to Customs statistics for 1917-18 cost the Commonwealth £427,393. The sulphur passes up the smelter stacks as SO_2 (dioxide of sulphur). It can be collected in water. By the nitric acid process a portion can be turned into sulphuric acid. The H_2SO_4 thus formed can be used to act on pyritic ore yielding H_2S, which is passed into another portion of the SO_2 solution. Then the following reaction yields flowers of sulphur:—$SO_2 + 2H_2S = 3S + 2H_2O$. The sulphide acted upon, if zinciferous copper ore be used, is thus converted into soluble sulphates, from which the metals can be recovered by electrolytic precipitation without smelting.

COPPER.—As a copper-producing area North Queensland holds the premier position in Australia. The close geological resemblance of the Chillagoe area to the Bisbee district, Arizona, and the geological analogy between the Cloncurry area and the Lake Superior region, are factors which promise long life to the copper-mines of North Queensland.

SILVER-LEAD.—In these metals North Queensland, and espe-

cially as regards the Chillagoe-Herberton mining districts, is very rich.

Tin.—As a tin region it is my opinion that North Queensland is not quite equal to the Northern Territory, but it is a good second. The districts of Herberton, Irvinebank, Koorboora, Kangaroo Hills, Annan River, Stanhills, and Tate are all noted tin areas.

Zinc.—This metal is exceedingly abundant both in connection with copper lodes, like Mount Garnet, and silver-lead lodes, like the Mungana and Mount Albion mines, throughout the Chillagoe-Herberton districts. If North Queensland had zinc separation works, not only would she take a foremost place as a zinc-producing region in Australia, but a large number of mines now closed down on account of the zinc penalties would be reopened and worked.

Antimony.—Large antimony lodes occur in the Northcote area, near Mareeba, and thence at intervals along the Hodgkinson belt to Groganville, on Limestone Creek. The biggest are the Mitchell River antimony mines.

Wolfram and Molybdenite are richly distributed in North Queensland. Bamford, Wolfram Camp, and Kitchener are leading localities, but Mount Carbine, Percyville, and many other parts of the Etheridge are also tungsten and lig producers.

Gold.—The future of gold production in North Queensland looks poor at present, as the rich alluvials of early days were mostly derived from veinlets and small lodes which are not payable. Only large bodies of auriferous stone are likely to pay continuously so as to make a sound investment, and Kidston is the only field that seems to some extent to satisfy the test.

Suffice it to say that North Queensland is by far the richest part of Australia as a mineral country. Its development may be delayed through the prevailing ignorance in the Southern States about North Queensland, but it will and must come.

AGRICULTURAL RESOURCES.

The wonderful fertility of the basalt and slate country behind Cairns is too well known to need elaboration. The entire coastal belt of North Queensland, where the topography is not too rugged to preclude cultivation, is rich agricultural land well suited for tropical crops.

On the tablelands situated within the Pacific climatological zone dairying is also a highly profitable industry.

However, as soon as we get over the divide on the westerly fall, where the galahs put in appearance, the semi-arid climate of the

Gulf country prevails. The semi-arid areas are not suited for cultivation except by market gardeners employing irrigational methods. There are, however, considerable areas of loamy deep soil retentive of moisture, even over these areas, which could grow cotton. The difficulty is to start the crop. Irrigation is needed when the plants are young. The matter is one for experiment.

PASTORAL RESOURCES.

The Gulf fall of North Queensland is essentially mining and pastoral country. It is not sheep country; the grass seeds are much too ferocious. Only small areas can be styled fattening country, but most is good breeding country for big stock. The great trouble is the poverty in permanent surface waters.

This trouble is not insurmountable. The purchase by the Government of numerous stations should result in much good. Former owners were satisfied to stock the country up to the capacity that natural permanent waters allowed. The Government, I understand, is adopting a vigorous policy of sinking bores and building dams, so that the carrying capacity of the State stations will be vastly increased. That is true development. That means increase in the productivity of the State. It must give pleasure to all who agitate for more production to know that there is now a move being made to greatly increase the stock-carrying capacity of our State.

Another trouble affecting pastoral interests in the North is the frequent devastating bush fires, which run for hundreds of miles at the time when grass is most needed. These can only be effectually checked by the early burning of belts of country as fire-breaks. Such burned areas would be of further advantage in giving early green feed in case of early rains.

To burn fire-breaks, stations must of course employ more hands than was customary in the past. But it pays. It is an insurance against heavy losses. When the settlement of the North proceeds so that the entire expanse of North Queensland is chess-boarded with settlement areas, farms, or stations, not exceeding 10,000 acres in area, the numerous roads will be a quite effective check to fires, as it is in the South to-day. Until then, fire prevention by the early burning of fire-breaks is essential to the expansion of the pastoral production of North Queensland.

Speaking in a general sense, North Queensland compares favourably with any part of Australia in possibilities—mining, pastoral, and agricultural—and should have a great and prosperous future. Past mismanagement and prejudices, fostered by ignorance, have hampered and are hampering its development.

THE FLOWING WELLS OF WESTERN QUEENSLAND.*

By Dr. J. Gust. Richert,

Late Professor at the Polytechnical University of Stockholm.

Professor J. W. Gregory, in his address to the Royal Geographical Society of Australasia, Queensland, on 3rd September, 1914, has repeated and completed his theory of the origin and the nature of the artesian water found in the Great Australian Basin. Having already made some remarks to Mr. Gregory's classical work, "The Dead Heart of Australia," in a pamphlet on "The Subterranean Waters of Australia," published 1916, I am bold enough to take up for discussion also some main points of his abovementioned address.

Before going into particulars I wish to state that the new reasons given by Mr. Gregory for his plutonic theory have strengthened my conviction that he is right on that point. I do not hesitate to declare that the plutonic tributes probably represent a very great part of the artesian stream. Nevertheless I feel convinced that this fact does not upset the hydrological theory, based on meteoric tributes. There are layers fed by rain water and other layers fed by plutonic water, all confirmed in one great artesian basin. There are veins of different origin now going apart under the influence of different pressures, now joining under the same pressure, all together forming a continuous artesian stream, slowly moving towards the sea.

In the following I would like to make some remarks thereby, using the same headings as Mr. Gregory.

THE NATURE OF FLOWING WELLS.

According to Daubrèe, flowing wells which overflow owing to other forces than water-pressure are called pelocones.

"These wells flow in consequence of several different agencies. The flow may be due to the weight of the overlying beds, which press down on the water-bearing beds and squeeze the water out of them if an outlet be opened from them by a bore. If a piece of wood with drilled holes through it be pressed down on a wet sponge, the water will be squeezed out of the sponge and escape up the holes; this experiment illustrates the nature of wells due to rock-pressure."

I will take up these suggestions under the heading "The influence of gas and rock pressure."

"It is well to remember that water-pressure, gas-pressure, and rock-pressure may work together."

In this point I wholly agree with Mr. Gregory. These three factors constitute an artesian stream, receiving tributes from above and from below, moving towards the sea in directions determined by the minimum resistance.

THE OUTLETS FROM THE CENTRAL BASIN.

"Another fundamental principle of the old water-pressure theory was that the water in the central area was kept fresh owing to its continuous

* Communicated to the R.G.S.A.Q. by Dr. Richert, Stockholm, January, 1920.

renewal to replace that discharged into the sea. This discharge was attributed to four outlets. The outlets to the south and south-west have been generally abandoned; that to the sea at Brisbane is known not to be used by anything more than a mere trickle of water, even if by that; and to use the remaining outlet, that to the Gulf of Carpentaria, the water would have to rise from more than 4,000 feet below sea-level in the central basin over a barrier 400 feet above sea-level. Professor David* has justly remarked that on this hypothesis the facts are difficult of explanation. These difficulties may be realised by examination of Professor David's section across the basin; and they seem to me insuperable.

''Professor David has suggested that the outlet may be by undiscovered channels through the rock barriers, or by the mound-springs on the south-western edge of the area; but neither suggestion seems probable.''

Fig. 1 gives a schematic section of the northern outlet, derived from page 306 in ''The Dead Heart of Australia.''

Contrary to Mr. Gregory and Mr. David, I cannot find that the hypothesis of an artesian outlet in the Gulf of Carpentaria is difficult to explain.

In conformity with Mr. David, I am of the opinion that the artesian basin may have an outlet through the rock barrier in the south. The map on page 14 of Mr. Gregory's address, completed with the isopotential lines on Map No. II. in ''The Dead Heart of Australia,'' shows a series of strong fractures according to Fig. 2.

Following the example of Mr. Gregory, I will try to illustrate this suggestion by means of an experiment. Suppose that a basin formed by stone with perforated bottom receives water partly from above and partly from the bottom holes, with an outlet in one direction. Suppose, further, that the basin will be cut through the opposite edge, one part sinking below the other, those two parts divided by the fracture. The effect must be a new outlet through this fracture.

In this way I think the southern outlet mystery may be explained. The artesian water in the southern part of the artesian basin will force its way through the fractures into the sea. Numerous plutonic springs will send hot water into the basin or into the fractures forming the southern outlet of the basin. The truth of this suggestion might be proved by analyses of water taken from the bottom of the sea along the ford lines.

THE INFLUENCE OF GAS AND ROCK PRESSURE.

''The uplift by the expanding gases is probably aided by the heavy pressure of the overlying rocks. The action of the rock-pressure has been denied. The evidence for it seems convincing. As a test case, consider the Kynuna wells. In one bore there the water came from twenty-two layers of sandstone which lay between thick masses of clay. The water from the top bed rose 40 feet, from the second it rose 80 feet, from the third 120 feet, from the fourth 360 feet, from the fifth 560 feet, and so on. From each succeeding layer the water rose higher until at length it overflowed at the surface; from the depth of 2,179 feet it rose 2,246 feet. The obvious explanation of these facts is that the deepest waters rise the highest because they are under the heaviest rock-pressure. These Kynuna wells have a life of from

* Federal Handbook, p. 278.

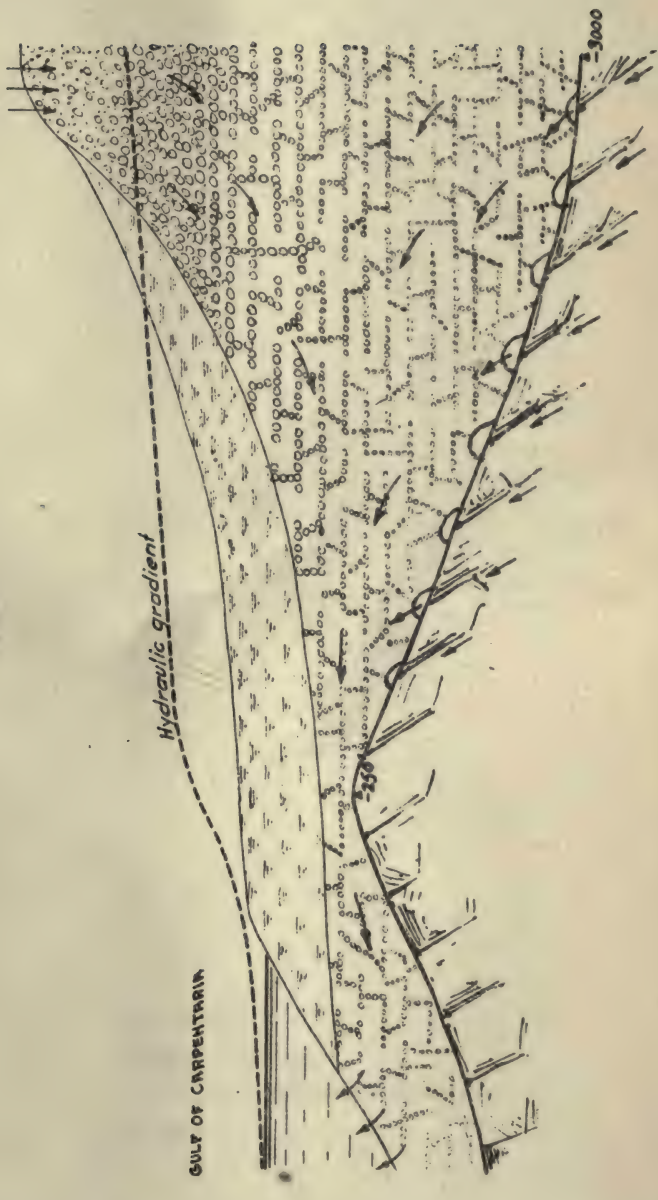

FIG. 1.

FIG. 2.

Rim of the Artesian Basin
Isopotential line
Direction of the artesian stream
Fracture

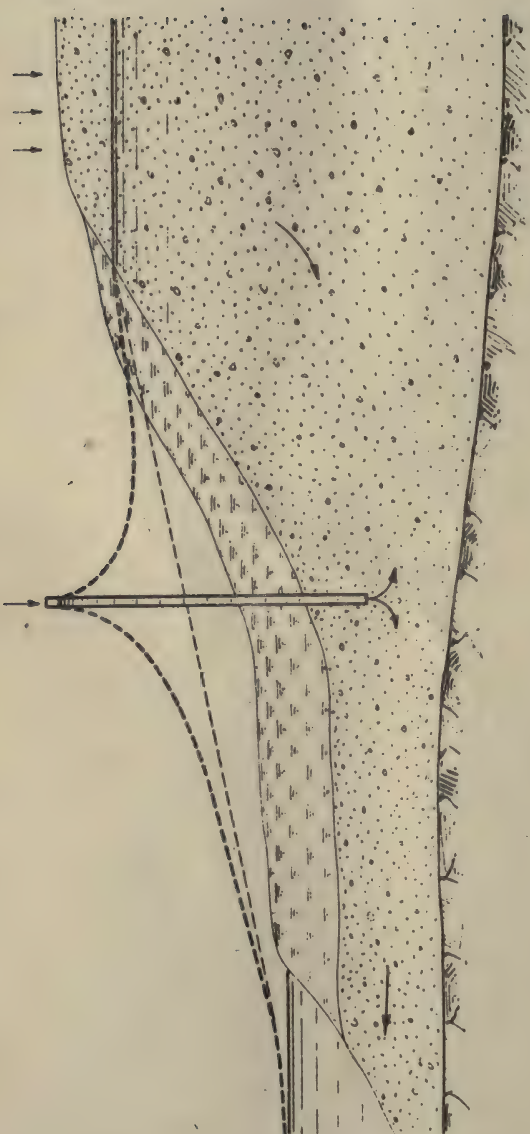

FIG. 3.

five to seven years; they then fail because the surplus water has been squeezed out of the beds. A section through the area shows that the supposed intake beds, 120 miles away, are lower than the level to which the water rises at Kynuna. If the ascent of the waters were due to water-pressure the upper beds should derive their water from a lower intake than the deeper beds, and this supposition is inconsistent with the actual levels of the country.''

The difference in piezometrical levels of the water rising from different layers not being mentioned, it is difficult to determine the rock-pressure influence. Under no circumstances can the effect of that pressure be illustrated by the experiment of Mr. Gregory on page 3,* viz., ''a piece of wood with drilled holes pressed down on a wet sponge.'' That wood acts through its full weight, with addition of the pressure enacted upon it. If the water found at a depth of 2,179 feet were influenced by the whole weight of the overlaying mass it would rise at least to 4,000 feet. There may be another reason for the fact that the piezometrical level of the water is increasing with the depth of the wells. In Fig. 1 I have tried to indicate that the horizontal channels are not so wide in the deeper layers as in the upper ones, owing to the increasing rock-pressure. In consequence of this *indirect influence* of the rock-pressure the frictional resistance to the percolating water is increasing with the depth, causing a greater water-pressure and a higher water-level.

It is not impossible to connect the high piezometrical water-level at Kynuna with a lower free level in the supposed intake beds. If surface water is pumped into the basin through an infiltration well, as indicated in Fig. 3, the water-level within a certain distance can rise higher than the level in the upper part of the stream. The effect will be the very same if water is forced into the basin from a strong plutonic vein.

THE ORIGIN OF THE WATER.

According to Mr. Gregory, the water is derived from four different sources—

''1. Rain-water which percolates underground along the exposed edge of the basin;

''2. Water which was included in the beds during their formation and has been stored up in them, as in a closed cistern, ever since; this water of 'cisternage,' as it is generally called, Professor Walther has recently happily described as 'fossil-water';

''3. A further supply of fossil-water probably soaked into these beds at an earlier geological period, when the Queensland watershed was further to the east and there was a much greater discharge of rain west into the central basin;

''4. Last, but not least in influence, is plutonic water which rises from the interior of the earth. Numerous hot springs, and the ruins of volcanoes of comparatively recent geological date, occur around the artesian area. The adjacent country is traversed by numerous recent fractures, which have had a profound influence on the topography of Eastern Australia; and it is the rule for hot springs to occur only at such fractures. It would be passing strange if none of these fractures have affected the artesian area, since some of the earth movements were certainly later than the depositions of the clays which cover the water-bearing beds; and a map kindly

* *Queensland Geographical Journal,* Vols. xxx.-xxxi., page 3.

> prepared by Dr. Richards shows that some of these faults strike towards the area. Hence it is very probable that hot waters do rise from beneath the earth and enter the permeable beds and there accumulate until the pressure is sufficient to prevent the entry of any more water; and if a bore put down to the water-beds, then the influence of this plutonic water forces the mixed waters to the surface.''

Regarding 1 and 4 I fully agree with Mr. Gregory. Regarding 2 and 3 it is my opinion that a *closed* subterranean basin filled by ''fossil-water'' cannot give any artesian water at all. The water being an incompressible body, no surplus water can be stored by pressure. A well bored into such a basin may give salt water for some hours, but not fresh water during many years.

''What percentage of water in these beds is plutonic cannot be satisfactorily determined. Mr. Symmonds has estimated the amount as 80 per cent., which is much higher than my estimate. The bulk of the water seems to me water of cisternage, and the energy of the plutonic water is probably more important than its quantity. But instead of the further evidence inducing me to reduce my estimates as to the quantity of the plutonic water, I believe the amount is greater than I at first thought. The new facts collected during the past eight years have, it appears to me, steadily reduced the proportion that should be attributed to the rain, and increased the proportion of plutonic water.''

The cisternage water is, as pointed out above, of no importance at all. As to the quantity of the plutonic water Mr. Gregory seems to under-estimate his own arguments. The pulsation observed in a large number of wells, the high temperatures, and the boric acid have strengthened my conviction that the plutonic sources must be, with regard to quantity as well as to energy, of a very great importance.

''Eight years ago orthodox opinion held that rain-water could work its way to great depths below the surface; but the physical difficulties in that process, and the invalidity of the experiments that were thought to prove it are now being more clearly recognised. Most authorities on water supply now agree that only under exceptional conditions and to a limited extent can the surface waters descend 2,000 feet below ground. Thus a recent letter from Dr. C. F. Becker, an eminent American authority on this question, remarks that in the experience of himself and his colleagues 'meteoric waters are very seldom indeed found penetrating over 2,000 feet from the surface.' The belief that the deep central basin of Queensland is being constantly recharged with rain-water rests on conceptions of the circulation of subterranean water which are now out of date.''

To the suggestion of Mr. Becker I take the liberty to add the following remark:—The length of an artesian basin very seldom exceeds 1,000 miles.

No hydrological engineer will deny the possibility of this length, even in very irregular layers. I suppose it will also be difficult to prove the impossibility of a vertical deviation of 4,000 feet, which is certainly only a small fraction of the horizontal deviation of the different veins constituting the artesian stream, which all, under more or less variable pressure, move towards the sea. I dare to hold up the ''orthodox'' opinion, that the circulation of subterranean water is not ''out of date.''

Mr. Gregory himself has admitted that at least one part of the artesian water is of meteoric origin. This water *must* flow to the sea, and the plutonic veins joining this stream must flow the same way.

Nevertheless, I find it probable that the vertical deviation of the water will take place chiefly in the upward direction. Where a vertical communication exists between two horizontal channels of different depths the water will stream in the direction offering the least resistance. There are—as indicated in Fig. 1—good reasons to believe that the upper layers are more porous and offer less resistance than the deeper ones, consequently the deeper veins will force their ways to the upper layers. Another reason for this suggestion may be the high gas- and water-pressure of plutonic springs.

To judge from the very incomplete informations relative to the different wells, deeper wells often give more abundant flows than shallow wells. In the deeper layers the erosive effect of hot plutonic springs may have resulted in wide local fractures. If so, the best means to get water out of the basin are deep artesian wells, and the best means to get surface water into the basin are deep infiltration wells. But the horizontal movement of the stream probably takes place chiefly through the upper layers.

THE PROBABLE DURATION OF THE WELLS.

''The pressure and discharge of the wells have both fallen seriously. During the past fifteen years the discharge from the 124 Queensland flowing wells which have been remeasured has fallen 40 per cent. In New South Wales the fall in yield has decreased* 38 per cent. in ten years. Many wells have ceased to flow, and in the still flowing wells the pressure has decreased one-third in the last five years; and the rate of decrease is accelerating.''

In the face of such facts it will be difficult to deny a general depression of the hydraulic gradient.

Of course many wells may have ceased to flow owing to the choking of the pipes or leaking into layers under less water-pressure. Such technical failures occur in all artesian water supplies. Certain irregularities in the decrease are due to differences in respect to the ''specific yield'' and to the loss of pressure in the pipes. The general depression of the hydraulic gradient will reduce the flow from all wells, but not in the same proportion.

In ''The Subterranean Water of Australia'' I have pointed out the necessity of calculating the specific yield of each well of importance. By means of recurrent observations of this kind it will be possible to determine if the decrease of each particular well is due to technical or hydrological conditions.

In the discussion following the address of Mr. Gregory I have noticed the following words of Mr. Phillips:—

''We are, however, on safer ground when we contemplate the enormous quantity of water that undoubtedly exists in the vast underground reservoirs of ' Artesia' if we might so name the great Australian artesian basin. These reservoirs, placed deep down in unfathomable mines, where neither sun nor wind can get at them, might easily contain from 1,000 to 2,000 cubic miles of water, according to the mean thickness of the porous strata and the coefficient of porosity. Taking the mean thickness of the beds at 200 feet and the coefficient of porosity as 15 per cent., the quantity of stored water in Queensland

* Increased?

would exceed 2,000 cubic miles in volume. Such a vast volume of water could not be exhausted by the existing flowing wells of this State in 6,000 years, and yet we are told that the yield is decreasing at the rate of 8 per cent. per annum after a period of less than thirty years.''

According to my opinion the deep water storage of the basin is of no importance at all. The pores of these layers still are filled with water, as they were in old times, and will remain in the future. The water storage exhausted in thirty years is the comparatively small quantity corresponding to the general depression of the free water-level *above* the wells.

In addition to these remarks I dare to repeat some suggestions of mine in ''The Subterranean Waters of Australia'':—

A continuous stream percolates through this basin, fed partly by meteoric tributes from the abovementioned intake beds and partly by plutonic tributes from the depth The stream is flowing in two different directions with outlets in the Gulf of Carpentaria and somewhere on the southern coast.

In the course of years a progressive decrease of the flow from the wells has been observed. This annoying fact is *not* a proof of local stores of water being emptied by the wells, but a perfectly natural consequence of the disturbance of the original equilibrium state. Every new well causes an increase of the water tapped above ground and a decrease of the quantity flowing to the sea; a decrease of the velocity of the water percolating through the fissures; a general depression of the hydraulic gradient corresponding to the velocity; a decrease of the pressure on the wells corresponding to the hydraulic gradient, and of the yield of the wells corresponding to the pressure.

By means of recurrent observations of the water-level and the flow it is possible to calculate the *specific yield of each particular well,* as well as *the specific yield of the whole stream* in a certain cross-section. When these factors are known, it is possible to calculate the constant quantity flowing to the sea, as well as the yield of new and of existing wells under different pressure.

The hydrological question of Australia ought to be solved—

By *economy with the flow of artesian water;*

By *investigation of the natural yield of the subterranean streams;* and, above all,

By *artificial infiltration of surface water.*

Surface waters should be led into the underground at places convenient for infiltration, and brought to the surface again at places convenient for consumption.

The artesian streams can be supplied with surface water, stored up in reservoirs and led into the underground by means of *irrigation plants* or *infiltration basins* in the intake beds, and by means of *infiltration wells* within the artesian basins. Every subartesian well can be changed into an infiltration well under a pressure up to the surface level, and every flowing well can be changed into an infiltration well under a higher pressure, produced by pump machinery. Every infiltration well will increase the yield of the stream, the inclination of the piezometrical level, the pressure in the flowing wells due to the water-level, and the yield of the wells due to the pressure.

WESTERN EXPERIENCES IN 1885-6.*

By W. H. Davidson.

Early in the year 1885, while our State was still in the throes of the awful drought of that period, the late Mr. Staff-Surveyor C. Twisden Bedford was instructed to proceed to Boulia with his camp, and carry out a traverse survey from that out-of-the-way township to the South Australian Border, to enable the Queensland Government to check the position of the Border Line, at that time recently defined by Surveyor Poeppel for the South Australian Government. Mr. Bedford selected the writer to act as his assistant. We left Brisbane early in May for Townsville, and after some little delay to enable the camp, which had been at Cardwell, to travel to the then terminus of the railway line, we reached Betts Creek, now Pentland, and were joined a few days later by our outfit.

BETTS CREEK TO THE FLINDERS RIVER.

The country about Betts Creek was sandy, flat, and uninteresting, but fairly timbered, the only excitements being the arrival of horse and bullock teams with loading for the railway line, a fine corroboree by about 300 natives in full costume, and the activities of Mr. John Robb's railway construction camp, which was busy pushing the line in the direction of Hughenden.

On the arrival of our camp we left Betts Creek a few days later, traversing some very poor, sandy, timbered country until we had passed Bullock Creek. We had trouble in finding sufficient grass and water for our horses, which were low after the long rough journey from Cardwell. We had to drink what water we could find, and the dust raised when travelling was very trying and the flies a great nuisance, but nothing to what we found them further west. We had trouble in getting our horses safely through the poison-bush country near Torrens Creek, and had to camp with them as a measure of protection.

When crossing the high ground before getting into the Flinders River valley we saw our first trees, and noted the pretty native mimosa covered with brilliant yellow, highly scented flowers. Our first sight of the fine open country made one feel like one of Xenophon's Ten Thousand when first the Black Sea appeared in view. Unfortunately, owing to the grip of the drought, that fine country was being sorely tried, and grass and water were not by any means plentiful.

In due course we reached Hughenden Run and camped for a few days to spell our horses not far from the head station. While there we experienced a nice fall of rain early in June. We found conditions slightly better after leaving Hughenden, but suffered from the bitter cold winds on the exposed open country both by day and night. Telemon and Marathon Stations, off to the west of the road, looked comfortable, pretty holdings, with trees about them.

At the "Thirty-mile Bend," on the Flinders, the cold was so intense that a bucket of water brought from the river at sunrise, and placed about five feet from our camp-fire, froze a layer of ice on the surface which prevented

* Communicated to the Royal Geo. Soc. Aus., Q'land, by the Author.

dipping out the water with a pannikin. Our horses, a great anxiety to us, began to show the effects of the dry, cold weather, and it was a problem to get them enough grass to keep them going about the fifteen miles per day with full pack-loads and our loaded wagonette with instruments, tools, tucker, guns, and ammunition. In due course we reached the turn-off from the Flinders towards Cloncurry with the loss of one horse only.

All down the Flinders we noted the desiccated remains of a mob of cattle which had travelled to the Woolgar River in the earlier stages of the drought. The brands on these dry remains were quite distinct, and practically the whole hide, except along the ventral line, was intact. These remains represented the major portion of a herd of 2,000, of which we were informed some 250 reached their destination alive. They lay around and in the small waterholes, from which we had to draw our supplies, in dozens, and we were thankful for the lapse of time since they made the journey.

Even under the drought conditions one could not help noting the magnificent country on the Flinders, especially on Dalgonally Run, where we came across our first experience of the weird ''roly-poly,'' which looks like an animated hay stack, and several fine mirage effects, with their wonderfully deceptive inverted reflections. We also noted the brilliance of the afterglow in the western sky, which was caused by the terrible eruption of Krakatoa in the Straits of Sunda some years earlier. Game of good variety was obtainable all down the Flinders, and many fine bustards were seen, besides numbers of wild ducks, both of which, upon occasion, made a welcome addition to our rough fare of beef and bread.

Our health was very good, fortunately, and we had not up to that time experienced such ailments as Barcoo rot, Belyando sickness, ophthalmia, or Gulf fever. Owing to the condition of our horses some of us walked most of the way from Richmond to Cloncurry. Our camp at this time comprised H. McIlwaine, a North of Ireland man, and later a well-known novelist, who was out for experience; Robert Child, a superannuated master mariner, one-time Arctic explorer, and later gold digger at Gulgong; and our horse-boy, a fine little Norfolk lad of about sixteen years, not long out from England. As we approached Cloncurry the country became more hilly and poorer, and water was obtained from wells fitted with force-pumps and troughs, each traveller raising the water required for his cattle and camp.

CLONCURRY AND CHATSWORTH.

In due course we reached Cloncurry, and took advantage of having some surveying to do there to send our horses out to the Native Police camp, at that time under our present Commissioner. We camped at the racecourse, about three miles out of Cloncurry, at a fine lagoon in the river, in which was a crocodile of the long-snouted, harmless kind, so its presence did not debar us from bathing in the lagoon. One night we visited the Cloncurry copper-smelting works, and were interested in watching the process, as they had managed to get the copper to ''run'' after a great deal of delay and trouble, but, being strangers, our presence was not pleasing to those in control. However, about a year later, on revisiting Cloncurry, the manager of the works very kindly showed a party, including the writer, over the works. On this second visit the stuffed skin of our old friend the crocodile was seen under the Divisional Board hall. It was a fine specimen about seven or eight feet long.

It was wonderful in those days to see the great blocks of almost pure copper ore encumbering the surface in every direction as one approached Cloncurry. The surroundings of Cloncurry were rather picturesque, with the forbidding Black Mountain just across the river, but one gained the impression that great heat prevailed there at one long-ago period.

There is some wonderfully level, smooth-surfaced country near the racecourse very suitable for aeroplane grounds, and lying between some low ironstone ridges in the vicinity of which our compass proved very erratic, being deflected as much as 28 degrees. We had our first experience of spinifex on some of these ridges, and were not favourably impressed with its qualities. It is rather surprising to find gidya timber growing over such a wide range of country, both on the coastal and inland sides of the dividing range where climatic conditions are so different; but one gets plenty of surprising situations in our State. On completion of our work near the racecourse we carried out a small survey near the township and laid down a standard of sixty-six feet near the Divisional Board hall, and our work being completed we prepared to leave for Boulia, nearly 200 miles almost due south of Cloncurry. Our genial, kindly Irishman, Mac, left us at this stage, having had a call from "The Homeland."

A short distance from Cloncurry the river is crossed, and one passes Black Mountain, now called Mount Leviathan, and an inspection was made of the scattered bits of ore on the lower slopes. These looked as if they had been subjected to intense heat, and had a very bubbly appearance. Some poor, sandy, timbered country was traversed showing abrupt granite outcrops, and in due course the forbidding "Gorge" about 18 miles out was reached. This was a weird-looking break in a low, abrupt, rocky ridge composed of black burnt-looking boulders, giving the whole locality a most murderous aspect, which must have impressed even our dog, a Russian retriever, as during the night we camped there, he stayed with our horses about a mile from camp the whole night long, and on going early next morning for our horses, we found the dog on top of a big boulder looking after the animals near by, and gazing at our approach in a most threatening attitude.

This was the only occasion on a journey of some hundreds of miles that our dog stayed with our horses during the night, but perhaps he did not like the appearance of the "pub" at The Gorge, or possibly he got a glimpse of some of the hangers-on at the place. The instinct of these dogs is quite uncanny. They are savage, unsociable animals, rarely making friends with anyone, splendid watch dogs, never offering to leave their home to follow their master; but let mists or fogs prevail where roads traverse precipitous country, and driving at night even with good lights is risky, and the dog will be found just in front of the horses' heads acting as pilot, and the driver will soon be notified if he is going into danger.

After crossing the divide, better country is met with, open, undulating, and lightly timbered, especially as one approached the old Chatsworth dam, where we found the grass relatively good but water very low. The dam was a fine earthwork of several hundred yards in length, on the upper side of which several deep tanks had been excavated, but only one contained any body of water. From Chatsworth onwards we traversed nicely grassed country, fairly flat and lightly timbered, with patches of gidya and a line of eucalyptus along the watercourses.

We reached Noranside in due course and met that fine old pioneer, Mr. James Buckley, long since passed away. It was difficult to form much idea of the country about Noranside, as there is a good deal of timber about the station. We saw here the first aboriginals since leaving Betts Creek, and some of the men were fine specimens over 6 feet in height, with fairly good chests but, as usual, spindly below the knee.

We noticed a new kind of plant near Noranside—the Western peppermint. It is an upright-growing bush of some 4 or 5 feet with a brownish stem about ¾-inch thick, probably a labiate. The leaves, which are small, somewhat resemble those of the true peppermint of commerce, and contain an even stronger essential oil that is easily diffused by a pint of hot tea, a very effective means of keeping away flies. This plant only grows in damp spots along the edges of so-called watercourses, and is not at all plentiful, but is found over a wide stretch of country. We found that a leaf of this plant when placed in each nostril was not only refreshing but was very effective in keeping the swarms of flies away from one's face.

BURKE RIVER.

After crossing the Burke River below Noranside the country becomes more open, with stony plains, and we came across myriads of tracks of a horde of migrating rats. Where they came from, where they went to, and what they lived on *en route* is one of the unsolved problems of our mysterious West. They were with us worrying our food supplies and our sleeping hours over a space of upwards of 100 miles. The softer parts of the soil were literally honeycombed with their burrows, and it was anything but pleasant to ride a horse across the rat-warrens. The direction of their migration appeared to be from N.W. to S.E., but this feature, no doubt, was clouded by the course of the rivers. This horde of rats was followed by a swarm of brown kites, which made a vain attempt to preserve the balance of Nature by destroying thousands of the rodents.

We reached Boulia about the middle of August, the weather having been gloriously fine, cold, and windy since we left Hughenden. We found more shelter close along the Burke River, but were glad enough to keep fires going quite close to our blankets at night, as we slept on the ground. We camped on the river about three miles above Boulia at a fine lagoon with a fine stretch of undulating, open, plain country, fairly well grassed to the N.W., overhauled our gear, standardised our ropes, and found values for our striding level.

BOULIA.

Boulia in those days was a small, nicely situated township on the west side of the river, placed on fairly high ground, and contained the usual two good stores, two hotels, butcher, blacksmith, a few cottages, police barracks, with nice post office across the street, with the residence of the police magistrate on the high ground at the top of the one street, overlooking the whole township. The township, unfortunately, was rather exposed to the prevailing winds, and had no timber shelter, making it a bitterly cold place at night.

SURVEYING.

Our first work consisted of laying down a meridian to start from, and we made a fixed point inside the corner of the post-office reserve close to the telegraph instruments, and got a nice base about half a mile due south for our meridian lamp, for which we used an ordinary bull's-eye lantern in a closed box with a half-inch circular aperture, and found this quite large enough even at a distance of over a mile. Our instruments consisted of a very good six-inch transit for field work and a very fine ten-inch open-plate Bamberg fitted with micrometers and enabling us to do close work with σ Octantis, our Pole Star, by means of tables worked out by Mr. Tully, the Surveyor General.

Winds and dust gave us great trouble with our observations. After about a week's cold work star-gazing, we fixed our meridian satisfactorily, and started our traverse by turning an angle on a bearing slightly north of west to hit a short distance above Herbert Downs Station, on the most western anabranch of the Georgina River, about 55 miles away. In this we were very fortunate, seeing that very little surveying, except by wheel and compass, had been carried out in the district.

While camped on the Burke River near Boulia we experienced a very fair sample of a ''simoom'' which lasted for several days. If one's hat blew off it was ''good-bye for ever,'' and the amount of dust we breathed, ate with our food, and drank with our tea, made life wearisome. Our blankets even became so impregnated with the impalpable dust that, on ''turning in'' at night, one sneezed and coughed almost till exhausted. A pint-pot of tea, if left exposed for a short period, would accumulate a deposit of silt about half an inch thick. About this time, the end of August, a horde of grasshoppers or locusts invaded Boulia and sought shelter in the houses, where hundreds were crushed under foot, causing a nasty odour.

About 1st September, 1885, we started measuring our line, after laying out some distance with pickets set by the theodolite. The method adopted was to measue out some distance with an undivided 100-foot steel band, putting in 4-inch square pegs at every 500 feet. Thermometer readings on the ground were taken at each end of the tape as we stretched it out at a pull of 20 lb., indicated by a spring balance fixed to the handle of the tape at the leading end. Each peg was set truly on line with the theodolite at the exact distance, and a small mark made on the top of the peg exactly at each 500 feet. This was followed up by measuring with a 66-foot tape, divided to links, and the distance to each peg recorded in chains, links, and decimals of a link, thermometer readings and strain of 20 lb. being maintained as before stated. As all these thermometer readings had to be recorded the work was necessarily slow, and we were unfortunate in not having the long, thin, steel bands and clinometers that are used nowadays in surveying.

We had great difficulty in getting suitable timber for pegs and the six-inch squared posts that we had to fix in the ground at every mile point, with the distance in miles cut on the posts with a chisel. These posts had to be painted a dark blue and the figures painted in white. At every five miles we had to place in the ground, below the squared posts, the neck and two-thirds of a bottle filled with cement, in the centre of which was inserted an empty brass rifle cartridge case. This bottle had to be fixed bottom upwards and the central point in the cartridge case set truly on line at exactly the five-mile point. As

these mile posts had to be sunk 2 feet in the ground the cement bottle had to be at least 2½ feet below the surface, and the fixing of these in summer time on a treeless plain, with a shade temperature of 120 degrees, made one feel that the English language was lacking in means of expression.

At every ten miles we had to take a series of observations for curvature of meridian, which sometimes kept Mr. Bedford and his assistant busy till long after midnight, and occasionally these observations had to be temporarily abandoned owing to dust, haze, clouds, or too much wind. This entailed a long ride back along our line at some future date after dark, to make the observations, and sometimes the trip had to be repeated several times to the one spot before we were successful. It was frequently getting on towards 3 a.m. before we ''turned in'' and we used to be at work again before 7 a.m. Fortunately, this only occurred at about every ten miles along our line.

About a fortnight after starting we shifted camp to a waterhole on Bengeacca Creek, about seven miles west of Boulia, and when we had completed about twelve miles of our line our chief was taken ill with some sort of fever and had to go to Boulia. The country thereabouts was fine open downs, rather stony in places, but so exposed that it was quite out of the question using a plumbob without using a temporary breakwind of some sort. We noticed a ''bilbie'' not far from Boulia. It was a strange-looking little animal with a short black and white tail. They must have been fairly plentiful in those days, as it was customary for the blacks, when in full costume, to wear a sort of garter below the knee from which depended the tails of the ''bilbie.''

About twelve and a-half miles out we crossed a low divide, and the country carried little patches or lines of gidya scattered about, giving a very pretty appearance to the grassy, undulating spaces. Thereabouts we noticed a family of three kangaroos, the only ones seen west of Boulia. As we were getting too far from water to work conveniently, we shifted our camp to a point on the Burke River, about fifteen miles below Boulia and several miles south of our line, but, as this entailed too much travelling, we secured a 36-gallon cask and took a supply of water, food, tools, and our blankets and camped at the end of our day's work, leaving our cook in charge of our base camp perhaps ten miles away at permanent water, to which we returned every Saturday evening.

While camped at our first stage from Boulia we met travellers returning from the Kimberley Diggings, which had started shortly before that time. The ''rush'' was practically ended by the wreck of the ''Ly-ee-Moon'' on the coast below Sydney, when some hundreds of lives were lost.

From our camp at the fifteen-mile on the river we came across some of the peculiar timber known as beefwood, which was growing on some sandhills in the vicinity. It looked as if it might be a relation of our she-oak.

GEORGINA VALLEY.

At about 20 miles from Boulia we entered a patch of gidya several miles wide, which was on the stony low ridge forming the eastern side of the Georgina Valley. This ridge terminated towards the south in a series of parallel sandhills about 50 to 60 feet in height and about 80 to 100 yards apart. They were composed of a coarse reddish sand and covered with spinifex.

and were so exactly alike that only a very close observer could detect any difference. There must have been a good deal of insect life about, as small rough-backed lizards, called by the blacks ''moorookoo'' and much relished as food, were plentiful. These sandhills are generally end-on to a watercourse, and sometimes terminate very abruptly almost right on the bank, at which point in the watercourse water is generally found. Where all this red sand comes from is rather a mystery, as the plains are mostly of grey or yellowish-grey cretaceous formation and the low ridges of a rather stony, clayish composition covered with gidya, often fairly grassed, and carrying a good deal of small saltbush.

At about the twenty-mile point, near where our line entered the belt of timber, some very peculiar conical mounds were seen. These mounds were about 3 to 4 feet in height by 8 to 10 feet in diameter, and composed of flakes of striped marble about 6 x 3 x ½ inches. These flakes are of two basic colours, liver-red or dark grey, with lighter bands of the same colours. A short distance further on and a few yards south of our line, several more were seen close together, but these were rather larger. Flies began to be bad about this time, and some of our party suffered from fly-blight, but soon recovered.

As we were now nearing the Georgina River we shifted camp to the Paravituary Lagoon in the river. This was a fine lagoon of some 20 miles in length, but, unfortunately, was very salt at the south end, and when the wind was from that quarter the water became almost too brackish to drink at our camp some 10 miles further north; and as the heat at the time was trying, and generated an awful thirst, our health suffered and ''Barcoo rot'' became prevalent.

The radiation was so great that it was almost impossible to use the theodolite after 9.30 a.m. owing to the distortion, so all instrument work had to be done very early and fairly late in the day, and some of the party found comfort in discarding all clothing above the waist-line except the necessary hat, during the midday heat, which was so great that an iron spud-bar or the brass tape-handles, if left out in the sun for a short time, became far too hot to be touched. We were thankful that the nights were nearly always cool.

Our line left the gidya belt at about the thirty-mile point and traversed coolibar flats for some distance on rather low ground, and later, as it approached the river it entered the worst patch of country we met with on the whole trip. This was a wide stretch of ''melonhole'' or ''devil-devil'' country running parallel with the river, and, as we were crossing it diagonally, our progress was slow and our work very trying. This ''devil-devil'' country is subject to inundation, and abounds in wide cracks in all directions, caused by the fierce heat of the sun contracting the soil while it is in a more or less damp condition. One can easily sink to one's knees in these cracks, and we found measuring across it taxed us almost to our limit.

A good deal of blue bush, also polygonum, grew on this area, which at some remote period was a shallow lake, in all probability. The blue bush is a well-known fodder plant growing about 2 feet in height and is wonderfully nutritious for stock. It looks something like midway between an ordinary, rather poor thistle plant and a lucerne stem, and grows in little stools about 18 inches apart. The polygonum is probably an Equisetum, and grows in brakes covering good big patches of ground. It has long trailers up to about

30 feet or so in length exactly like very much enlarged she-oak leaves, and appears to grow from a short central stem to a height of 4 or 5 feet and then just flow over in every direction like the head of a ''mop.'' It has no thorns and is an obscure-looking plant with a very astringent taste.

This ''devil-devil'' country was alive with fairly large snakes of a bright salmon-red colour. They were very alert, and disappeared like a flash, in the numerous cracks. Flock pigeons were seen here flying to and fro in countless thousands. They are a fine plump bird not quite as large as our wonga but better eating. It was most interesting to watch them come for a drink about 5 p.m. near our camp. They would fly around in a big circle in thousands, with the birds at one point fluttering down in a continuous succession on to a little strip of hard mudbank on which they settled close to the water, and ran quickly to the edge, taking one sip only and immediately rising to make place for those just behind them, and by continuing to circle around in this way every bird got all it wanted in an orderly manner without crowding or fighting.

Game was plentiful on the Paravituary Lagoon, even pelicans being about, and it was pleasant on Sundays to be close to the water under a polygonum patch and, by keeping very still and quiet, have the wild ducks come within a few feet of one and watch them dredge for spiral shellfish about a couple of inches long, which they swallowed shell and all. Sometimes the expression in an old drake's eye while he watched the observer was beyond description. One had to keep a wary eye for snakes on such occasions, as both black and tiger snakes were very numerous and of great size, and the latter would just as soon fight as run away. There were numbers of very dainty-looking little water-hens about, that were speckled and much the same colour as a guinea fowl. They also had red legs, but were finished off with a good big square tail like an ordinary fowl. Bustards were fairly plentiful, but we never did much shooting unless our meat supply was short or faulty. Fine fish are to be caught towards the southern end of the lagoon where the waters became salt. The soil thereabouts must be wonderfully fertile, and one wonders why the date palm is not being planted along the river, either by the Government or by means of a subsidy to Crown tenants under liberal conditions.

Shortly after crossing this bad patch of ''devil-devil'' country our line ran into a stretch of coolibar flats, with better going, and thereabouts ophthalmia attacked the writer. This painful complaint belongs to most plains country and causes great mental and physical distress to the sufferer, besides sometimes taking a long time to get rid of. It is quite a different thing from the ''bung-eye'' blight caused by the bite of a fly, and probably arises from the intense glare causing an inflamed condition of the eyes.

About 38 miles our line passed over a rather high, abrupt, isolated outcrop of apparently old red sandstone, from which a fine view of the surrounding country was obtained, but, unfortunately, no opportunity occurred for making a careful inspection of this outcrop. From there on we passed through some cotton-bush country, as we approached Cotton-bush Creek, which joins the Georgina in that vicinity. This plant is said to be good food for stock, and is a low-growing shrub of about 18 inches in height, rather dense growth with thin, stiff branches of a very spiky nature at the tips, although not armed with thorns. All this country was on Herbert Downs run, the boundary of which was about 15 miles out from Boulia.

NARDOO.

After crossing Cotton-bush Creek about 45 miles we crossed a fine patch of country with ''nardoo'' growing in patches. This plant is an annual and resembles the violet plant somewhat; the beans, which are about the size of a small cowpea seed, are rather flattened at the sides and slightly kidney-shaped, black in colour, and without pods, each seed growing on a stalk like a violet flower. After the seed ripens the plant dies down, and the blacks scoop up leaves, seed, and all and winnow it in the wind by dropping it slowly from the double handful into a coolamon, or small native wooden trough, from a height of about 2 feet, the wind carrying away the refuse. They then carry it to their camp and pound it roughly on a large flat stone with a small one held in the hand. This coarse meal they mix with water into a stiff cake and bake it in the ashes. They put on wonderful condition in a fortnight on this food, so it must be very highly nutritious as well as digestible.

HERBERT DOWNS.

Our line now ran quite close to and parallel with the river for some miles, and as clouds began rolling up we pushed our work on rapidly by working seven days a week for seven weeks, and managed to get our line across the river a few miles above Herbert Downs Station, leaving the marking up for a future date, and shifted our camp to the west side of the river near the station. A few nights later two station blacks appeared suddenly at our camp and advised us to move up to the head station at once; and as the ants had been unusually active for a few days previously we moved camp without further delay, but crossed the river back to our work daily. One afternoon, shortly after, while out with the empty wagonette and a pair of horses, we got caught in a slight downpour out on a plain, and the ground became so sticky that the wheels of our trap became almost locked against the brake-bar with the accumulation of dry grass and mud matted together, necessitating our having to clean the wheels with a tomahawk every few yards to enable the horses to pull the vehicle at all. Our boots, too, took up such masses of matted mud and grass that walking was hard work, so we decided to return to camp, and, on reaching the river, found the flood waters coming down in a solid wall a short distance up stream.

A few nights afterwards the rain came down in torrents, and by that time the river was about seven miles wide and we were completely cut off from all communication with Boulia. To allay anxiety in Brisbane regarding our welfare, one of the native stockmen, a station black, for a promised reward of some tobacco, took a message to Boulia. He left Herbert Downs Station early on a Monday morning and was back by 3 p.m. on the Thursday following, a total distance of over 100 miles, and, as he left at the height of the flood, he must have had to swim upwards of 20 miles and wade up to waist-deep for more than 10 miles; and he stated that he had best part of a day's rest in Boulia, bringing back a note from there. He was in pretty fair trim when he returned, but lay about in his camp for three or four days with a tight cord ligature around each thigh about half way above the knee, as the limbs were rather swollen.

We were most hospitably treated by the laird of Herbert Downs, a good sportsman, a noted boxer, and a clever violinist; and after the weather

fined he soothed our music-hungered souls in the evenings with classical music, and caused great merriment when, by request of his head stockman—a North of Ireland man—he played "The Boyne Water," and all the blacks' dogs howled a lugubrious obligato. Owing to the softness of the ground after the floods it was impossible to continue our work for several weeks, so we had a well-earned rest about Christmas time, and the advent of two noted pioneers from further west—viz., James Kendal, of Amaroo, and L. Ffrench, of Gnallan-a-gea—made our stay very pleasant.

From Lake Amaroo, in those days, was obtained a great deal of salt that was largely used locally for curing beef. It was collected from the lake on precipitation when the waters became evaporated to below a saturated solution. It was dried and bagged for transport, but was a crude material with a lot of bite in it, but cured meat until there was no moisture left in it. It had all to be pounded on flat stones by the gins before being used, as it stuck together in lumps about the size of one's fist.

Herbert Downs Station consisted of four small buildings in those days, and was nicely situated on the end of a fairly high gravelly ridge close to the most western anabranch of the Georgina River, at a fine lagoon only a few yards below the station. The floor of the manager's house was paved with very fine, thin flagstones of a cement-like composition taken from the river crossing just below the station, and, in all probability, fine material for the manufacture of hydraulic cement will be obtained from the Georgina Valley at some future date, when there is more settlement and groves of date palms are a feature of the progress of the district.

While bathing in the flood waters one could not help being struck with the sluggish Nile-like current of the stream, and this feature suggests some peculiar problems in connection with the lower portions of the rivers in the Lake Eyre Basin, probably the largest basin in Australia, and having its vortex about 40 feet below sea-level, a feature of probably enormous economic value in the future, when the time arrives for the development of our intensely fertile inland country.

A few weeks after the floods subsided the whole face of the country became a beautiful green stretch of rich grass and herbage—a most startling contrast to the brown, drought-stricken prospect, with its daily columns of dust whirlwinds, which were always visible no matter in which direction one glanced. With the break-up of the long drought came myriads of mosquitoes and flies to torture us night and day. There is a peculiar little insect out there known locally as "the privateer fly," man's one and only insect friend. It probably belongs to the wasp tribe, perhaps a thyunid or a chalcid. It catches and carries off flies, and it is entertaining to watch one settle near a fly on one's hand. It works around craftily until it directly fronts its victim a couple of inches away, and after making a few rapid vibrations with its short horn-like antennae, it runs up and grabs the fly in its mandibles, the fly seemingly having been mesmerised. Unfortunately for man and beast, these useful little insects are not very numerous.

As soon as the ground was sound enough we pushed on with our work, turning a big angle at the 55-mile post, the new line running nearly north, and practically parallel with the river. As everything was now in our favour our progress was good. The country was finer on the west side of the river,

and Mitchell grass was greatly in evidence. This wonderful grass, which has brought millions of money to our State, seems to get along very well with a rainfall of about 10 inches per annum, and it is probably the richest natural fodder in the Southern Hemisphere.

LAKE IDUMEA.

About the middle of February, 1886, we were approaching Pituri Creek, near where it joins the river, and it was considered advisable to shift our camp to the border line and work back along the creek while water was available. This meant a journey of several days, and *en route* we passed Glenormiston Station, on the bank of a fine sheet of water known as Lake Idumea. Here we met that fine old pioneer Alexander Lamond, who was very kind to us. Lake Idumea, although rather shallow, was a fine sheet of water several miles long by about half-a-mile wide, and it made a great impression on our party as, except flood-water, we had not seen so much good, drinkable water for hundreds of miles.

LAKE WONDITTA.

Twenty miles above Lake Idumea another fine sheet of water, Lake Wonditta, occurs in Pituri Creek. It is not as large as the former but is more picturesquely situated, being bordered along its western side by some relatively high rocky ridges which fall very abruptly to the lake. This lake was teeming with the greatest variety of wildfowl imaginable—spoonbill, ibis of kinds, ducks of many varieties, geese, swans, dabchicks, and hosts of waders and swimming birds rarely if ever seen in South-east Queensland. Life of all kinds, from the reptile and bird downwards, was in profusion, but we saw few marsupials; dingoes were very numerous, also emus and bustards of great size, and we noticed a pretty jerboa-like little animal with large erect ears and a feathery-looking tail. It was so active that three of us could not catch it as it ran about our wagonette, although it was only about the size of a large rat.

The coolibar timber was finer along Pituri Creek than on the river, and we came across some isolated patches of young bloodwood trees about 6 inches in diameter, and one solitary well-grown ironbark of about 18 inches diameter, and well proportioned. How these trees got out into that locality is a mystery, as we never came across any parent trees that they might have originated from. On the ridges forming the east side of Pituri Creek valley we found growing a small, bushy tree very like the European olive. This tree makes little or no stem but stools close above the surface, sending up a number of branches to a height of 8 or 10 feet. It only grows on rocky ground, and we did not observe any fruit. Besides gidya and coolibar, we used for pegs and posts for our line some very beautiful scented timber known locally as minnievitchie (native name) or lancewood. It has a peculiar, thin, reddish bark all in little curls up the stem, like the feathers on the back of a French hen. It has a very thin, yellowish white sapwood with a dark, shiny brown heartwood, and is a very heavy, hard timber, but splits as freely as brigalow, and as it had clean straight stems of 5 or 6 feet in length and almost 8 inches in diameter, it suited our purpose well. We found this timber growing in one locality only.

Another peculiar plant out there, of low-growing habit, was observed. It is branched just like a candelabrum in shape, and about 8 or 10 inches in height, on a short stem a few inches above the surface. All the branches are single stems only, and grow upright and are round, fleshy, and leafless, and snap like a young French bean. They are quite lacking in fibre, and exude a white milky, sticky juice, and are about half an inch in diameter and of a pale grey-green colour. It grows amongst the gidya, and is rarely seen.

To one brought up on the coast lands, with their wealth of plant life, with the yearly routine of young growth, flower and seed, some of these Western plants are cryptic in the extreme, and suggest a development along peculiar lines for a great period of time. The whole of Nature out there seems to be out of balance, as one finds huge areas of most magnificent pasture without an indigenous animal to consume it (perhaps they have become extinct), scanty rainfall, some forms of animal and insect life in extreme profusion, and yet others lacking, the whole country of an inscrutable and sphinx-like aspect, and yet, to an observer, quite the most interesting patch of country to travel over in Australia. East of Lake Wonditta is to be found some of the finest grazing country in the world. Above this lake the valley opens out somewhat, and Lake Titah is met with in a pretty open stretch, but is only a small sheet of water. Some miles above Titah—about ten—one comes to the Walaya Lagoon, on the South Australian border.

LAKE TITAH.

Between these two sheets of water, while ascending the flat valley of Pituri Creek, we came across old wheel-tracks of a two-wheeled dray. The tracks were faint but quite distinct, and appeared to have been made a great many years before and were baked as hard as flint in the peculiar marly soil of some areas in that locality. The most peculiar thing about these tracks was the size of the timber growing between the wheel-marks. This gave the observer a distinct shock, as that country had not long been occupied by white men. The head stockman of Idumea or Glenormiston knew little of these tracks, and could give no information to account for the age of the timber growing between the wheel-marks. The soil where the tracks were noticed is of a peculiar cement-like, marly nature which will retain an impression for years if it be made while the soil is moist and is afterwards baked by the hot sun. These tracks ran in a N.W. and S.E. direction along the right or west bank of Pituri Creek some miles on our side of the border. Similar tracks had been found in 1880, about 150 miles N.W. and about the same distance slightly S. of W. from where we observed them, and were reported to the South Australian authorities by two explorers, who were convinced from the surroundings that the tracks were those of Dr. Leichhardt's party, as some of the evidences that the tracks were of great age were indisputable.

The peculiar nature of the soil in retaining these impressions, made while it was in a plastic state, suggests that certain of our Western areas may in the distant future supply quantities of fine material for the manufacture of earthenware, perhaps in the days when Lake Eyre has been converted into a large shipping basin by connecting it with Spencer's Gulf, by means of a canal,

and our inland areas are made more accessible and possible of profitable development. At present we are too much taken up with political squabbles to pay much attention to business.

PITURI CREEK.

But to return to our work. As we approached the border we noticed smoke signals on every prominence ahead of us, as we rounded the spurs of low ridges jutting into the valley of Pituri Creek. These signals were made by the wild natives to warn their neighbours of our approach, and had been expected more or less by us, as a gin left Wonditta hurriedly as soon as we arrived there; but they never gave us any trouble, although our meridian lamp used to be interfered with by something now and again, but the natives were so scared of a bull's-eye lamp that the trouble was credited to perhaps an emu or a dingo. When taking a ''latitude'' one night at Herbert Downs some of the blacks ventured near, but were terribly afraid of the bull's-eye lantern, until one of the blackfellows said to a gin, ''What you frighten of, you warrigal? That feller quart pot.'' This was because the lantern had two wire handles at the back, like an old-fashioned quart pot.

The Georgina River blacks were a well-set-up, clever lot, and made good nets out of fibre of some sort, and twisted yards and yards of three-strand twine out of opossums' fur, which the men wound around their waists as a belt. Their boomerangs also were miracles of poise and proportion, and being made of gidya, a timber of relatively high specific gravity, were much more potent weapons than those made by the coast blacks. They were also clever at working flint, and, while travelling at the back of one of the station drays for a few days, a native fashioned a very neat flint dagger for Mr. Bedford. It was about 8 inches in length, triangular in section, and tapered from about an inch wide at the base to a fairly good point. The handle was made of a knob of gum and wax, and the dagger was not polished. Some of the natives carried terrible scars across their backs and lower portions where their flesh had been scored in fights. Some of the cicatrices were about 6 inches long by over half an inch wide in parallel rows about 2½ inches apart, but were so regular that one was inclined to doubt their origin being due to fights. We came across a peculiar instance of curvature of the shin-bones in a native. He was otherwise a fine, well-built fellow about 5 feet 9 inches in height, with good muscular thighs, but from his knees downwards the bones curved forward so much that they entered the ankle at an angle of about 72 degrees. Needless to say, he was known as ''Boomerang.'' Some of the blacks were much darker in colour than others and had, in some instances, good woolly growths of hair all over their backs. Some showed a Jewish type of face, and had the habit of wearing a curl down each side of the face, the strands of the curl being held together at the tip by means of a bit of wax. This latter is also said to be a Libyan custom, and is depicted in some of the Egyptian sculptures of Libyan faces. For carrying about a supply of water they make use of the skin of an opossum, taken intact from the carcass and cured. This they fill with water and tie up the outlets, and use as a water-bag. Water carriers in the East use a goat's skin treated in much the same manner.

Strange to say the pituri plant is not found on Pituri Creek, but on Linda Creek, a western tributary of the former. The natives prepare the

pituri by placing about a big thimbleful in the mouth and macerating it for a while; meantime a small fire is lighted and the leaves of a kind of wattle reduced to a white ash in the fire, and, in a small trough of bark cut from a tree, sufficient of this white ash is then mixed with the chewed pituri to form a quid about the size of the top joint of one's finger. This is then moved around in the mouth for a few moments and transferred to the back of the ear, either for safe keeping or to ripen. Great quantities of a weed somewhat like our "fat-hen" grow on Pituri Creek, and it was tried as a vegetable when boiled, but was found to be too fibrous to eat. The country on Pituri Creek is very good, and some of the plains were a beautiful sight owing to the numbers of wild flowers of all kinds, probably all annuals. In time to come many of these beautiful flowers will find places in cultivated gardens all over the world, but the era of the Australian wild flower has barely started yet.

We were not long getting our work well away from the border, and came across some peculiar ring-mounds on quite flat ground. Some of these rings were of some considerable diameter, being a good many chains across. They looked exactly like a circular dyke raised as a protection to a human camp, and were difficult to account for, although the impression at the time was, that they had not been made by the native blacks, as the earthwork was far too extensive.

While camped near Lake Titah two tragedies occurred in our vicinity, a man having been murdered by the blacks about thirty miles west of us, and one of two travellers crossing the country from the Georgina River to seek work at our camp perished from thirst, his mate being found in a demented state, at a small pool of water. Their supply of water gave out owing to a leak in their water-bag when they were about half-way across, and they started to look for water and got lost. They were being piloted by a native, but he forsook them in the night. The poor fellow who perished was found within a few yards of a fine lagoon in the Georgina, as he had managed to get back, but succumbed to his terrible privations.

Only those who have experienced it can imagine the distress caused by lack of water on the plains in summer time. We came across strange evidences of elevated horizons, heat, and pressure in places, and also of apparently basalt sheets of only a small depth as if they were very nearly denuded. In one spot over a considerable area were found, amongst the Mitchell grass tussocks, numbers of circular flat stones of about 8 inches diameter and about ¾-inch thick, of a dark liver also dark iron-grey colour, and of a highly crystalline fracture. They looked as if they had been rolled out flat while soft and then baked. The material they were composed of was very hard, and the upper surface was only slightly fretted by the atmosphere, the under surface being much smoother, and they gave one the impression that they were in a way letters of a sort of geological alphabet from which "sermons in stones" might be deciphered. On one occasion, when sinking a hole for a mile-post, the formation was of a hard, pinkish, cement-like material somewhat similar to that found on the outskirts of Cloncurry, and in which gold was being found in those days, and not unlike some of the material found at Mount Morgan.

GLENORMISTON.

As our work neared Glenormiston some very smooth and even slopes were traversed, and on one occasion when our theodolite was fixed over a mile-post we could distinctly see four of our mile-posts back along our line standing up like black stumps on the whitish Mitchell grass slope. Below Glenormiston we made a junction with our old line near a peculiar sort of pass between two low, strange-looking ridges, nearly destitute of vegetation, and composed of some dark altered rock with quantities of flakes of a reddish purple stone, very smooth and hard and with a metallic ring lying about the surface.

One of the prettiest sights we noticed was a flock of seventeen emus feeding on a little plain, and they took very little notice of our passage quite close to them. In those days there was to be seen, on the Burke River below Boulia, the remains of an old emu trap or yard made by the blacks. It was composed of a line of small gidya trees on a low neck of land where the river doubled back on its course, making a fairly long point with a high timbered bank on the other side. From the regularity and isolation of the gidya trees it looked as if they had been planted by human beings, either as seed or young transplants.

It is a great pity that our party did not include a good botanist, also a geologist, as there would have been plenty of scope for both, and very little was known of the country in those days, as it had only a few years previously been traversed by Messrs. Hodgkinson and Carr Boyd (''Potjostler''). The latter was known far and wide by his pseudonym, and was seldom spoken of by his proper name even amongst the white men, and amongst the black stockmen he was ''Budgerie fellow Potjostler, always gib it tobacco.''

In spite of our onerous work we got plenty of merriment out of our lives, and it was a ludicrous interlude in a meal to see a couple of our party turn back somersaults with pint pots of tea in their hands when a snake suddenly crawled across our humble tablecloth, *alias* an old flour-sack, laid on the ground. On another occasion Mr. Bedford one night stooped to pick up a small stick with which to get a light for his pipe at a fire nearby, and got a great surprise when it wriggled out of his fingers and proved to be a small black snake with its head down a hole in the ground. On another occasion a black stockman asked permission to cook his supper, a snake, at our camp-fire, and when the snake began to sizzle on the fire one of our men, not knowing of the cooking, asked, ''What's that hissing noise?'' and on being told it was ''the snake'' he suddenly sprang to his feet and dashed away for about twenty yards, shouting out, ''Look out! look out!'' as he thought it was the hissing of a live snake crawling amongst us. It took us quite some time to recover before we could explain that the snake was nearly ''grilled to a turn'' and would shortly be ''bite and sup.''

In the summer our work used to begin at about 3.40 a.m. with ''boiling the billy,'' and end with the same duty at about 8 p.m., so we had not much time to make close inspection of any interesting-looking locality a little off our line except when moving camp. In about nine months we had twice measured a distance of about 156 miles and recorded thermometer readings at every chain, besides shifting our camp from time to time and being delayed by floods.

DEPARTURE FROM BOULIA.

As white ants were very bad out there, it is quite possible that very few traces remain of our work above ground, but perhaps the bottles of cement we placed at every five miles along our line may prove interesting to scientists of some future generation should they ever be unearthed, and, if in a good state of preservation, the letters on the brass cartridge cases will be a puzzle. It will be a great pity if these five-mile points have been lost for all practical purposes, as the surveyed line was very carefully measured, and as high-class instruments were used it might have been a good reference base in surveying the adjacent country at some future date.

Our work being completed, and as the writer's health was not good, it was considered advisable to leave for Boulia, a distance of about 65 miles, without any water for horses *en route.* By taking a small supply in a water-bag and giving one's horse a drink just before starting at about 3 p.m., and getting some distance on the way before dark, the difficulty was overcome. On camping for the night the writer had a strange experience just before midnight, becoming aware in his sleep of something apparently blowing in his face, and on quickly opening his eyes was startled to see a pair of big eyes close to and gazing into his face. For the fraction of a second the impression was "Blackfellow!" and in another instant a shot would have been fired, when the midnight visitor, a big owl, sailed on to an overhanging branch, and the sigh of relief that followed might almost have been heard 100 yards away.

Boulia was reached about sundown the next day, and during a few days' stay there some nice specimens of opal and a very fine specimen of amber were shown the writer by a local man. The specimen of amber was a core about 1½ inches in diameter by about 9 inches in length, taken from a bore in the district, according to report. About a week's rapid coaching from Boulia *viâ* Cloncurry saw the writer at the terminus of the railway line between Hughenden and Betts Creek, and Brisbane was reached in due course.

THE FERTILE WEST.

The development of our great fertile West is a problem for the future, and its day is not yet, but by means of "dry farming" and carefully planned experimental work by the State Government in starting in suitable localities date-palm plantations, and other areas under the olive, vine, almond, fig, and apricot, a great deal might be done by drawing attention to the possibilities of many fertile areas that could produce something more profitable than, say, one bullock to ten acres. We are too much wedded to our traditional industries of raising beef, sheep, wheat, and minerals, and are apt to overlook the fact that our State is practically a continent of varied climate and soil which will produce practically all the requirements of man, if we place on our lands settlers who are experts at growing to perfection the many fruits at present imported into Australia in large quantities.

In Southern California, in the Coachella Valley, a desert sandy area about 250 feet below sea-level, some 500 acres have been planted with the date-palm with the most promising results, and an extension of the area to some 40,000 acres is going on. A start was made by the United States Government planting a small area and proving the suitability of the soil and climate for date-growing, and now towns are springing up and investors laying out capital, and a new industry has been added to the already long list of industries of the United States. We can do likewise if we care to make the experiment.

FAREWELL ADDRESS TO HIS EXCELLENCY THE GOVERNOR-GENERAL.

The following Farewell Address was prepared and sent on to His Excellency the Governor-General on the eve of his departure from Australia, 15th September, 1920:—

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

To His Excellency the Right Hon. Sir Ronald C. Munro-Ferguson, P.C., G.C.M.G., LL.D., Honorary Fellow and Patron.

Your Excellency,—On behalf of the Executive, the Council, Fellows, and Members of the Royal Geographical Society of Australasia, Queensland, I desire to express to Your Excellency their high appreciation of the stimulating patronage you have been pleased to extend to the Society during the successful term of your high office of State, as Governor-General of the Australian Commonwealth, as well as of the very great services rendered to the cause of science by your active and practical participation in the promotion of geographical knowledge and the benevolent influence you have exercised on the intellectual and industrial life of the country at large.

In giving regretful expression to their keen sense of the great loss which they, in common with all local workers in the pioneering field of research, will sustain by your early departure from the shores of Australia, my colleagues desire to tender you their cordial thanks for the spontaneous manner in which you have, by personal effort and lofty example, promoted the pursuit of geography and contributed to the advancement of scientific investigation.

During your long and strenuous term of service—as one of the greatest Empire workers of modern times—covering, as it did, one of the most critical periods in history, my co-workers recognised your exceptional claim to their regard as His Majesty the King's most worthy representative, as well as geographer and eminent statesman, and they will always look back upon the time during which you so happily occupied the distinguished position of Patron with feelings of great pleasure and the utmost gratification.

In wishing you and Her Excellency Lady Helen Munro-Ferguson long life and the fullest measure of happiness, it is felt that as a Representative Honorary Fellow and Eminent Patron of this Society you will still continue to advance its interests in the Mother Country, and I beg to assure Your Excellencies that you will both carry with you from the Australian shores the grateful remembrance and hearty good wishes of our Executive, Council, Fellows, and Members at large.

Signed on behalf of the Royal Geographical Society of Australasia, Queensland.

J. P. THOMSON, Hon. Secretary and Treasurer.

GOVERNOR-GENERAL'S REPLY TO FAREWELL ADDRESS.

GOVERNOR-GENERAL, COMMONWEALTH OF AUSTRALIA.

Melbourne,

September 23rd, 1920.

Sir,—I beg to acknowledge, with grateful thanks, the Address you have presented to me on behalf of the Royal Geographical Society of Australasia, Queensland.

It has always been a great pleasure to me to be associated with a Society which has done such good service in the cause of science, and in the promotion of geographical knowledge; and I am glad that I was able, before leaving Australia, to preside at one of its Annual Conferences.

I am much touched by the appreciative manner in which you refer to my services as His Majesty's Representative, and I cordially thank you for the good wishes you have expressed for both Her Excellency and myself.

You may be sure that, if in the future I can serve the interests of your Society, it will always be a very great pleasure to me to do so, and that I would always welcome the opportunity of meeting any of the Fellows and Members of your Society who visit the Old Country.

I trust that the Queensland Branch of the Royal Geographical Society of Australasia will continue to flourish and receive the hearty support of the community.

I am, Dear Sir,

Yours sincerely,

R. M. FERGUSON,

Governor-General.

The Secretary,

Royal Geographical Society of Australasia, Brisbane,

Queensland.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

Thirty-fourth Annual General Meeting, 28th July, 1919.

His Excellency Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S., &c., President of the Society, in the chair.

There was a large attendance, including Lady Goold-Adams and Captain Cosens, A.D.C.

The minutes of the previous monthly meeting of the Society were taken as read, and duly confirmed.

Elections.—Members: George Stanley Coleman and A. W. Drewe.

The Hon. Secretary and Treasurer (Dr. J. P. Thomson) read the Annual Report of the Council, and submitted the financial statement, duly audited. These were adopted on the motion of Messrs. J. P. Wilson and B. L. Schooley.

Captain Andrew Lang, R.F.C., then gave an address on "Experimental Testing and High-Flying," with lantern slides. The vote of thanks to the Lecturer for his most interesting address was moved by His Grace Archbishop Duhig, seconded by Alderman Whatmore, and carried by acclamation.

The following officers and Council were elected for the Session 1919-20:—

Patron: H.E. Rt. Hon. Sir Ronald C. Munro-Ferguson, P.C., G.C.M.G., LL.D. *President:* H.E. Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S. *Vice-Presidents:* J. P. Wilson, Esq., Hon. W. F. Taylor, M.D. M.L.C. *Hon. Sec. and Treas.:* Dr. J. P. Thomson. *Other Members of the Council:* B. L. Schooley, Esq., C.E., J. A. Fraser, Esq., C.E., B. Dunstan, Esq., F.G.S., Most Rev. Archbishop Duhig, D.D., &c., E. J. T. Manchester, Esq., M.E., G. W. Whatmore, Esq., Hon. A. J. Jones, M.L.C., L. A. Wilkinson, Esq.

Diplomas of Fellowship were afterwards presented (1) by Mr. Wilson to His Excellency the President, and (2) by His Excellency the President to the Hon. W. F. Taylor, M.D., Messrs. H. W. Mobsby, and H. Baynes.

Annual Summary, Thirty-fourth Session, 1918-19.

In submitting to the Fellows and Members of the Society the Thirty-fourth Annual Summary and Financial Statement for the official year ending on the 30th June, 1919, the Council is gratified to find that the numbers on the Membership Roll continue to increase, there having been added to the list of active supporters the names of some ten representative members. Although this shows a smaller accession than the previous year's enrolment it must be borne in mind that the usual activities of the Society were much interrupted for several months before the end of the Session owing to the influenza epidemic, during which time the monthly meetings were entirely suspended,

and this unfortunately occurred in the cool season, when the work of the Society is usually carried on with energy and enthusiasm.

Death has again robbed the Society of the following greatly esteemed supporters, whose loss the Council greatly deplores:—The Rt. Hon. Sir Wm. MacGregor, G.C.M.G., etc., one of the first Honorary Corresponding Members of the Society, an Honorary Fellow and Past President, Gold Medallist of the Parent Society, England, Explorer, Administrator and former State Governor, whose interest in the welfare of the Society continued up to the hour of his unexpected death, so widely lamented throughout the British Empire. Of the more active Members there have passed away—Mr. C. Battersby, of Georgetown, North Queensland, and Alderman John Crase, former Member of the Council, both of whom had received the Diploma of Fellowship; Mr. C. J. Collins, of Tamrookum; and Mr. Robert Fraser, Fellow, Life Member and Hon. Auditor for many years.

Besides the usual exchanges from kindred bodies and Government departments, the library has been further enriched by an acceptable donation of several volumes of the "National Geographic Magazine," received from Mr. G. H. Perry, Life Member, to whom cordial thanks are due. There has also been donated to the Library, by the Proprietors of London "Punch," an enlarged copy of the famous "Punch" cartoon "Unconquerable," executed in colours by the artist, Mr. Bernard Partridge. This striking and finely produced plate has been framed and now hangs on the end of the new wing of book-shelves, the warm acknowledgment of the Society having been communicated to the generous donors in the usual manner. An interesting accession to the general reading matter in the Library is here mentioned for the first time, and consists of the Sunday issue of the London "Observer," the Overseas edition of the "Daily Mail," and "Christian Herald." These, with other general and current scientific literature, are placed on the Council table and available at all times to Fellows and Members of the Society.

Included in the practical work of the Session were the following illustrated addresses:—

1. "A Midwinter Tour through the North Coast Districts and Snowfields of Mt. Kosciusko, New South Wales," by Dr. J. P. Thomson.
2. "The Turk at Home," by Mr. E. E. Edwards, B.A.
3. "Britain at War and at Work," by Mr. J. J. Knight.
4. And finally there is the lecture to be delivered at our Anniversary Meeting this evening on "Experimental Testing and High-Flying," by Capt. Andrew Lang, F.R.C.

To the authors of these interesting and instructive addresses the Society is deeply indebted.

In accordance with the "Constitution and Rules," the Council has conferred the Diploma of Honorary Fellowship of the Society on His Excellency, The President, Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S., "for signal services rendered to the Society and to geographical science in the field of exploration as well as for his valuable contributions to geographical literature"; and on Mr. Clifford H. Hay, "for very special services rendered to the Society in his position as Secretary, Premier's Department, New South Wales, and for assistance rendered in the prosecution of geographical

research.'' In this connection the Council has pleasure in recommending that the Diploma of Fellowship under subsections (*a*) and (*b*) of Section IV., Clause 3, ''Constitution and Rules,'' be also conferred upon—The Hon. W. F. Taylor, M.D., M.L.C., Vice-President; Mr. H. W. Mobsby, F.R.S.A., Hon. Lanternist; Mr. W. A. Dudley Le Souef, C.M.Z.S., M.B.O.U., Vice-President, Victorian Branch of the Society; His Excellency Hon. J. H. P. Murray, C.M.G., Administrator of British Papua; Mr. Harry Baynes, an old and staunch supporter; and Mr. E. C. Barton, F.R.G.S., former Councillor.

The Council has pleasure in also recommending—

1. The suspension of so much of the ''Rules'' as provides for the payment of an entrance fee.
2. The appointment of Mr. George Phillips, C.E., as Hon. Auditor in place of Mr. Robert Fraser, deceased; and the reappointment of Mr. H. W. Mobsby as Hon. Lanternist.
3. The reappointment of the Hon. F. T. Brentnall, M.L.C., and Mr. Alexr. Muir as Hon. Members of the Council.

In concluding the sessional work of the Society the Council rejoices in the realisation of the hope, so ardently expressed at last annual general assembly of our Members, that the War would be brought to a successful termination before the date of this meeting.

Statement of Accounts of the Royal Geographical Society of Australasia, Queensland, from 1st July, 1918, to 30th June, 1919.

	£ s. d.	£ s. d.
DR.		
By Funds at Close of Last Accounts—		
Balance in Government Savings Bank	..	134 2 7
Subscriptions Received	..	183 15 6
Chief Secretary—Half Cost of Printing Journal	..	58 6 11
Interest on Government Savings Bank Deposit ..	..	2 16 6
		£379 1 6
CR.		
To Expenditure as per Accounts—		
Gas	1 19 5	
Fire Insurance Premiums	1 8 10	
General Printing and Postage	51 16 11	
Printing the "Journal"	122 11 9	
		177 16 11
Advertising Meetings	4 6 0	
Cleaning, &c.	9 4 6	
Expenses of Meetings and Refreshments ..	8 12 7	
Repairs, Fittings, and Hire of Chairs	6 10 6	
Typing and Clerical	8 11 6	
Incidentals	6 8 5	
Stationery	2 10 6	
Hon. Treasurer's Account	50 0 0	
Telephone Rent	5 7 1	
		101 11 1
Balance in Government Savings Bank	..	99 13 6
		£379 1 6

Examined with Vouchers, Bank Pass Book, etc., and found to be correct.

GEO. PHILLIPS.

12/7/19.

Monthly Meeting, 23rd October, 1919.

(His Excellency Major Sir Hamilton Goold-Adams, G.C.M.G., C.B., F.R.G.S., President of the Society, in the Chair.)

ADDRESS ON "WATER CONSERVATION AND IRRIGATION," BY MR. E. J. T. MANCHESTER, M.E., PRESIDENT OF THE METROPOLITAN BOARD OF WATER SUPPLY AND SEWERAGE, AND MR. GEORGE PHILLIPS, C.E.

Notes of Mr. Phillips's Remarks.

Mr. Phillips said that owing to the very brief time available it would be necessary for him to curtail his remarks.

The conservation of water had been the declared policy of every Government for the past thirty years or more, but so far no practical effect had been given beyond certain cursory examinations of more or less favourable localities.

In the years 1889 and 1890, Messrs. Rigby and MacKinnon, hydraulic engineers of considerable experience in India and elsewhere, were continually employed by the Government in examining and reporting on twenty-four separate projects, extending from Oxley Creek, in the immediate neighbourhood of Brisbane, as far west as the Warrego River; as far north as the Johnstone River on the coast; inland to the Flinders River near Hughenden; and south to the Albert and Logan Rivers. The irrigable areas dealt with totalled 367,800 acres. The estimated cost aggregated £3,230,783, equal to an average of £9 per acre. At present prices of labour and material, the estimate might be doubled. So far, not one of the projects had been given effect to.

Hitherto the only irrigation scheme attempted by the Government is that at Inkerman, on the right bank of the Burdekin River. This project was based upon the eminently successful efforts of the Messrs. Drysdale Brothers, of the Pioneer and Kalamia sugar plantations, in the neighbourhood of Ayr on the left bank of the Burdekin River. This grand irrigable area owes its existence to the very finely comminuted soils of the northern portion of the Burdekin watershed, more especially that part drained by the Star River and its tributaries. Mr. Phillips inspected that district for the Government in 1898, and was greatly struck by the extraordinary width and depth of all the principal watercourses owing to the very friable nature of the soil. Many millions of tons of sandy soil had been swept down the river and deposited in the deltaic formation near the mouth of the Burdekin. Being exceedingly porous, the deposited material is heavily charged with water admirably adapted for plant growth, easily got and raised through perforated pipes arranged in groups and operated by steam engines.*

Messrs. Drysdale's irrigation was initiated in 1885, first by pumping from open lagoons, of which there are several, but as the work extended it was found more convenient and economical to provide separate pumping plants drawing water from tube-wells. By 1919, no less than 180 separate pumping plants were in operation, watering from 50 to 200 acres each. The water is

* The Cape River, another and more western tributary of the Burdekin, also drains a very extensive area of sandy formation, which also must have contributed much porous material to the Ayr delta.

raised from 10 to 30 feet, by means of 8-inch pumps, each raising on an average about 1,000 gallons per minute, the total effective horse-power being 1,100. The cost of an 8-inch pump with steam or gas engine has been about £1,000. No subsoil drainage is necessary at Ayr.

The Government irrigation scheme at Inkerman is designed to serve 100 farms—the pumps will be driven by power derived from a centrally situated electric plant. The cost to date has been about £130,000, but water is not yet distributed.

The Messrs. Young, of Fairymead, on the northern side of the Burnett River, a few miles from Bundaberg, have availed themselves of a similar but not so extensive an area of deltaic formation, from which they have raised much water for the irrigation of their canefields by means of tube-wells.

It appeared to Mr. Phillips that similar deltaic formations offer the most convenient and least expensive sources of water supply for irrigation purposes. Such localities as the lower Nerang, Coomera, Pimpama, Albert, Logan, and Brisbane Rivers in the South are worthy of careful investigation, whilst there are several rivers to the north, such as the Mary, Boyne, Calliope, Fitzroy, Pioneer, Don, Herbert, Johnstone, Russell, Barron, Endeavour, &c., some of which, at least, should afford large supplies of underground water at shallow depths. These underground supplies are not liable to loss by evaporation, whilst losses by percolation are very gradual, and, as a rule, unimportant, being more than compensated by infiltration from the parent sources.*

The only other irrigation work on a large scale in Queensland is that of the Messrs. Gibson Brothers, of Bingera sugar plantation, near Bundaberg. This was initated in 1902, and only used regularly during the drought of 1902-3. Some 2,000 to 3,000 acres are irrigable, but only about 1,500 acres have been watered. The water is pumped direct from the Burnett River, and the supply was found to be adequate. In this case subsoil drainage was found to be necessary. The pumping plant is only occasionally used to supplement deficient rainfall, which is not frequent. About £30,000 was expended on this work.

Before leaving the subject of underground water Mr. Phillips said that vast supplies were stored in the islands adjacent to the southern mainland of Queensland, notably Stradbroke, Moreton, and Fraser Islands, which are almost entirely composed of wind-blown sand, and receive heavy annual rainfalls. The average rainfall at Dunwich, on Stradbroke Island, is about 63 inches per annum, whereas the annual average for Ipswich in only 37 inches.

In the extensive belts of wallum country, met with near the sea-coast between Maryborough and Bundaberg and elsewhere, large supplies of underground water are available at quite shallow depths. He had no doubt that market gardening could be successfully prosecuted in wallum areas, on raised plats in order to secure efficient drainage, combined with the free use of suitable fertilisers. The water could be raised by inexpensive windmills when required, for such areas are usually within good rainfall belts.

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* At Carpentaria, the best source of supply for irrigation purposes is the Gregory River, which is a perennial stream with a large, constant flow in the driest seasons, and drains the vast limestone deposits of the Barkly Tableland, which are very porous.

As regards the storage of water by dams for irrigation purposes, Mr. Phillips said he was somewhat sceptical of success, except in small and favourably situated areas. The loss by evaporation was so great, whilst distribution of the stored water would generally prove a difficult and costly matter.

In a paper which he read before the Society on 13th October, 1910, on "The Loss of Water due to Evaporation, Percolation, and Absorption, with special reference to the Brisbane Water Supply," Mr. Phillips referred as follows to the then proposed reservoir on Cabbage-tree Creek, a small tributary of the Brisbane River about eleven miles above the Mount Crosby pumping station:—"In the light of recorded experience of the Enoggera reservoir in 1909, during which year the registered rainfall at the reservoir was 32.64 inches—or about 5 inches less than the average annual rainfall for that locality—the net value of Cabbage-tree Creek basin would be about one million gallons per day, provided the water be conveyed to the pumping station by pipes, and not, as is proposed, by the natural channel of the Brisbane River. During such years as 1877, 1878, 1881, 1885, and 1902, the basin of Cabbage-tree Creek would not contribute any water to the pumps at Mount Crosby *viâ* the natural channel of the river, as the whole of the water would be lost in transit."

It is now some five years since the fine concrete retaining wall was constructed and completed at Cabbage-tree Creek. The reservoir has not yet been filled, the highest level yet attained being 10 feet below the level of the bywash. *In January, 1920, the level of the water fell to 30 feet 5 inches below the bywash. At that time the reservoir contained less than 30 per cent. of its full capacity, whilst the loss of water in transit viâ the bed of the river from the reservoir to the pumping station was estimated at 60 per cent. The net result was that in January last, only about 600,000,000 gallons could have been drawn from the reservoir, sufficient for about 40 or 50 days' full supply to the City.*

Ever since the drought of 1902, Mr. Phillips had held that the Brisbane River could not be depended upon to supply the metropolitan area for all time. This is now admitted by the President of the Metropolitan Board of Water Supply and Sewerage in his last annual report, in which he points out the necessity of seeking additional sources of supply other than the Brisbane River and its tributaries.

As regards the dependable yield of the reservoirs in actual operation near Brisbane, Mr. Phillips after careful investigation found that the average daily yield of water per acre of the respective drainage areas were approximately as follows:—

Enoggera Reservoir	84 gallons
Gold Creek Reservoir	81 gallons
Cabbage-tree Creek Reservoir	55 gallons

No doubt in heavy wet seasons the yield would be considerably greater, but in such seasons water is not required for irrigation. His estimates as above were based on years of rather scanty rainfall, when water for irrigation purposes would be in demand.

The advantage of water stored up for irrigation purposes is sufficiently obvious to need no stressing, but the practical application will, in many cases, prove difficult and costly, and, he feared, not as a rule very satisfactory.

The Metropolitan Board of Water Supply and Sewerage might advantageously have inaugurated a sewerage farm instead of the present scheme, which involves the discharge of the entire sewerage of the city into Moreton Bay, which is so hedged in by the mainland on the west, Moreton and Stradbroke Islands on the east and south, and the Humpybong Peninsula and Bribie Island on the north, that there is scarcely any perceptible tidal current in the vicinity of the proposed outfall at Luggage Point. No matter how carefully the effluent may be treated, the deposit of undesirable slimes on the sandbanks near the mouth of the river, which are exposed at low water, is inevitable. At present about 10,000,000 gallons of water are brought into the city per diem, and the quantity required will surely increase from year to year. This water, of course, is absolutely under control, and could more readily have been utilised to irrigate some suitable area, than to discharge it into the Bay, and thus pollute the best natural health resort convenient to the city.

Mr. Phillips pointed out that a great mistake was made in not consulting the Government Geologists before deciding upon driving a deep underground sewer through the deltaic formation between the Hamilton and Luggage Point, which, of course, is full of underground water. He referred to the enormous beds of sand, gravel, and shingle that exist along the channel of the Brisbane River, from above tidal influence to the head, in the vicinity of Nanango, and the certainty that millions of tons of those materials must have been carried down by floods in past ages and deposited fanwise on the north side of the River below the Hamilton. Such materials, of course, form porous water-bearing strata that would inevitably prove very difficult to penetrate by deep excavations such as are required for sewers.

In June, 1914, Mr. Phillips prepared a pamphlet on the subject for the ''Moreton Bay Health Resort Protection League.'' Three thousand copies of that pamphlet were printed at Mr. Phillips's sole cost, and distributed amongst the leading men and local authority members of the metropolitan district. On page 7 of that pamphlet, Mr. Phillips said:—

''It would be difficult to find a more unsuitable place than Luggage Point to locate the outfall of Brisbane sewage. From the Hamilton for more than six miles the sewer tunnel would have to be driven through the alluvial delta of the river. There is not a river in Queensland that, for its size and drainage area, carries more silt in the form of sand and gravel. From the end of tidal influence to its head near Nanango, the channel meanders through continuous beds containing enormous quantities of sand, gravel, and shingle. During past geological ages the river-floods have carried millions of tons of those materials, and spread them out fanwise below the Hamilton. Subsequent ages have covered those deposits with finer particles of alluvium, forming the present surface. It will be seen, therefore, that the engineers responsible for the construction of the sewer have a very difficult task before them, and it should be borne in mind that difficulties of this nature have to be translated into hard cash, repayable with interest by the ratepayers of Brisbane and surrounding districts comprised within the sewered area.''

Mr. Phillips said his warning had fallen on deaf ears, but his forecast had been verified, for the driving of the deep tunnel had proved too difficult a task, and had to be abandoned at and below some point in the vicinity of Pinkenba, and a pumping station substituted in order to lift the sewage to a comparatively high-level sewer excavated in open cutting.

Mr. Phillips concluded by saying, that he had no intention of reflecting upon the President of the Board or the Engineer in charge of sewerage, because those gentlemen were brought from Melbourne and Hobart respectively and had no local knowledge of the Brisbane River and its basin. The responsibility, therefore, for an engineering blunder of the first magnitude, the results of which would be felt more and more in the future, rested upon other shoulders.

FAREWELL DINNER TO HIS EXCELLENCY THE PRESIDENT.

One of the most brilliant and successful functions ever arranged by the Royal Geographical Society took the form of a farewell dinner to His Excellency the Governor, President of the Society, and Lady Goold-Adams, at the Belle Vue Hotel, on Friday evening, 19th December, 1919. The tables were beautifully decorated with flowers and coloured ribbons, the central arch being surmounted by an exquisite design, emblematic of the Society and bearing the motto ''Ob Terras Reclusas.'' The Hon. W. F. Taylor, M.D., M.L.C. (Senior Vice-President), occupied the chair, and the vice-chair was filled by Mr. J. P. Wilson.

The following ladies and gentlemen were present:—

C. C. Warren
Wm. Effey
J. A. Walsh
Mrs. D. M. Allan
P. W. Cameron
J. Peart
B. L. Schooley
Mrs. J. D. Steele
J. Forsyth
Mrs. Lumley Hill
His Excellency (President)
Hon. W. F. Taylor (Chairman)
Hon. J. Huxham
Mrs. P. W. Cameron
Hon. P. Murphy
Mrs. W. R. Parker
Capt. W. C. Thomson
E. E. Edwards
H. W. Mobsby
S. P. Paull
H. Greene
C. Freeleagus
Lieut. Lukan
E. F. Gilchrist
A. T. Noyes
J. A. Fraser
D. M. Allan
Mrs. W. C. Thomson
B. Dunstan
Miss Ada Thomson
Ald. Whatmore
Miss Dorothy Wood
A. D. Walsh
Lady Goold-Adams
J. P. Wilson (Vice-Chairman)
Dr. J. P. Thomson
Archbishop Duhig
Mrs. W. F. Taylor
George Phillips
Mrs. B. L. Schooley
Rev. Dr. Merrington
W. R. Parker
J. D. Steele
Miss B. Dunstan
H. Tryon
L. Thomson

In presenting His Excellency Sir Hamilton Goold-Adams with the Thomson Foundation Gold Medal, the highest award in the gift of the Society, and conferred only for distinguished services, the Chairman made graceful reference to the active interest which the Governor and Lady Goold-Adams had taken in the work of the Society during their residence in Queensland. The medal, designed under the personal supervision of a former Governor of Queensland, the late Field-Marshal Sir Henry Norman, had formerly been struck in London from dies engraved by Allan Wyon, medallist, and engraver to His Majesty the King, but in this instance, the medal had been struck at

the Royal Mint, Sydney, in fine Australian gold, and this arrangement would be followed in all future awards of the medal, as the dies had, on the suggestion of His Excellency, the President, been imported from London, and were now in the custody of the Royal Mint, Sydney. The Council of the Society had always exercised great care and discrimination in awarding the medal so as to emphasise the great importance and significance of the award, apart from its intrinsic value, the chief aim being to reward merit and stimulate geographical research, especially in Australasia, to which preference is usually given.

An address handsomely designed and illuminated (the work of a Brisbane lady) and contained within a morocco folder, was presented to His Excellency by Mr. J. P. Wilson, who said that the function was tendered to His Excellency in grateful estimation of his Presidency of the Society. Although the term would expire about the end of July next, the Society looked forward to the kindly and valuable services of His Excellency in no matter what part of the world his duties placed him. On behalf of the Council of the Society the speaker expressed his thanks for the very great interest His Excellency had taken in the work of the Society and for the interesting and instructive lectures from time to time he had delivered, and which have been preserved in the Society's Journal. Upon the subject of undertaking some original survey work along the Queensland Coast which His Excellency had urged the Society to adopt as a wide field for original research, the project was now actively afoot. In this connection Bartle Frere and Bellenden-Ker Ranges in the North would be operated on as soon as ever the financial arrangements for the task had been completed. These necessarily would have to be aided to some extent by public subscription.

Before reading the address, at the request of the Chairman, Dr. J. P. Thomson, Hon. Secretary and Treasurer of the Society, said:—

As most of those associated with our early pioneering work have passed away or ceased to take an active part in present-day doings, it seems desirable that their successors should have some general idea of what has really been accomplished in the Field of Geographical Science by this Society. More especially so on the present occasion, when we are assembled together to present the Thomson Foundation Gold Medal and a valedictory address to our esteemed President on the eve of his departure from Queensland. It is true that most of our supporters, even the younger members, are aware that the foundation stone of the Society was laid in the happy reign of Queen Victoria —1885—and it was during the latter years of the glorious Victorian Age that much of our best work was done. But very few indeed have any knowledge of some of the more interesting incidents associated with our pioneering struggles in the field of geographical activity, in the efforts put forth to keep the torch burning. Recognising the satisfactory and important nature of its initial work, the Society at the conclusion of its first year's operations was the recipient of a Despatch from the Secretary of State, dated 18th October, 1886, in which the authority of ''Her Majesty Queen Victoria'' was given for assuming the title of ''Royal.'' In the following, Jubilee year, and at the time of the Diamond Jubilee, the Society had the rare privilege of presenting addresses of felicitation to Queen Victoria, in common with other sister bodies in the British Empire, and these were acknowledged at the time with marked appreciation. A similar presentation of

an address of welcome was also made to Her Majesty's Grandson, our present King, when he visited Brisbane in 1901, as the Duke of Cornwall and York. Since then our work has greatly developed, not only in the matter of no inconsiderable and important additions to the geographical literature of the world through the medium of our widely distributed "Journal," but also to some small extent in the field of exploration and discovery. For at our instigation the Queensland Government was induced to give a substantial contribution (about one-third the cost) towards the expense of the Society's Australian Exploring Expedition to New Guinea, in 1885-6, and more recently the sum of £1,000 was subscribed by the State of Queensland at our request to the funds of the Captain Scott British National Antarctic Expedition (the other Australian States declining to subscribe), while in 1909 the Society sent the speaker to the Gulf of Carpentaria to identify and astronomically determine the position of the ill-fated Victorian explorers' (Burke and Wills) most northerly camp on the Boyne River. And now we are organising a scientific expedition to explore the Bellenden-Ker Ranges and Barrier Reef, North Queensland. Included in the domestic work of the Society is the establishment of one of the largest and most representative geographical libraries in Australasia, consisting of an immense collection of valuable scientific works of reference, maps, and atlases from all parts of the world, the whole in itself being an important asset to the State at large and a tribute to the public utility of the Society, which, in the words of our former Governor, the late Sir William MacGregor, is to be complimented "on its splendid achievements." From the start our Monthly Meetings, always largely attended, have been held with an unfailing regularity, unknown, it is believed, in the history of kindred bodies in Australasia at least, and many of these assemblies have been privileged to welcome as honoured guests and speakers some of the greatest explorers, travellers, and scientists of the age, including Stanley, Amundsen, Gregory, David, and MacGregor. From its inception the Society has aimed at a realisation of the true geography, and always endeavoured to emphasise its vital importance "as the living, fascinating thing it ought to be." It is only during "the course of the War," says the London *Observer* of September, 28th last, that "most of us learned enough about geography to be able to realise how considerable had been our ignorance of that science"; and, as an illustration of this view, Prof. Lyde, one of the masters of Geography said to the members of the British Association at Bournemouth recently that "the mistakes that were made in the course of the war were innumerable, and they were not made by civilian critics of military affairs alone, but by high military authorities themselves." In this connection he refers to the campaign in Roumania, where everything went so entirely contrary to expectations. Over and over again military operations were modified in the most drastic fashion by geographical facts to which insufficient importance had been attached, and by his showing, the movements of Mackensen and von Falkenhayn were less the result of superior strategy than of inevitable conformity to geographical facts. So it has been in all military operations of the past; in the settlement and development of territorial lands; in the pioneering enterprises extending to new countries, and in the march of Empire, as far back as history takes us. "The trouble about Geography, as about all sciences, is that people will not realise that science is not a subject, but a method. They collect facts and think that that is enough, but it is not even a decent beginning." The place assigned to

Geography in the educational life of this country is wholly inadequate, and as a great department of knowledge the subject is taught in an entirely ineffective manner. This the speaker endeavoured to show in a paper to our Society over thirty years ago, on "The Importance of the Teaching of Geography in the School." But it was merely like a cry in the wilderness, as the importance of the subject was not realised nor its bearing on the settlement and development of this great State understood. "Until Geography is employed as the interpreter of man and his past in the schools it can hardly perform its proper duty for man and his future in Councils and Parliaments. The world never looked more eagerly than now to education to play its part in expounding and explaining the past that civilisation may win a fuller meaning from the present and a firmer grip on the future. Geography still stands by, dumb in neglect, but willing to speak." Are we to profit nothing by the dearly bought experience of the past? Are we to cast aside and ignore the lessons of the Great War? Surely we owe a duty to the race as well as to our own country. Knowledge is progressive, and the fascinating science of Geography opens up to all a field of unlimited possibilities. It is—

"Now no more a fountain sealed;
Drink deep until the habits of the Slave,
The sins of emptiness, gossip, and spite,
And slander die."

In the future let us therefore continue as we have done in the past thirty-five years, fearing nothing, expecting nothing, but realising that in the Geographical Society we have a thing of vast possibilities whose aims are vitally important to the industrial and intellectual life of the State as well as to the Commonwealth of Australia at large. We are but the humble exponents of a glorious cause and the pioneers in a vast field of inquiry. Our work may be local rather than general but we are making history, and the fruits of our labours will be known for their worth long after we have passed away and our contemporaries both public and private have sunk into oblivion. From a lifelong experience I am more than ever convinced that in the affairs of a Society like ours too much importance cannot be attached to the selection of President. The idea of a mere figure-head, as in the case of the good old sailing ship of boyhood-times, may be all very well when in the hands of a loyal and trustworthy navigating lieutenant, but that is not always the case, and it too often happens that the good ship is wrecked or left stranded on the rocks and shoals of neglect, leaving in its wake a long trail of lofty aspirations and good intentions, but having, alas, failed to fulfil its function or serve any useful and lasting purpose. The ideal President is he who will have the welfare of the Society at heart, realising that his own honour and reputation will be reflected in its success as much as its success will reflect credit on himself and those with whom he may be associated in the work. In this respect we are fortunate in having as the head of our Society, an earnest, enthusiastic, and loyal worker, who we are sure will not be unmindful of our welfare though absent from the State. And we are also happy in claiming as our Patron the Governor-General of the Commonwealth of Australia, the Right Honourable Sir Ronald Munro-Ferguson, whose practical interest in the welfare of our Society is greatly valued and appreciated by all. In making these farewell presentations to His Excellency Sir Hamilton Goold-Adams, we realise that he leaves the shores of Australia as the President of our Society, in which office he will be in a position to represent our interest for some time longer wherever he may be.

The Governor, who was in unusually good form as a speaker, expressed the hearty appreciation of the gifts, which he assured the assemblage he would treasure very highly indeed. For one thing, they would remind him of many interesting and instructive evenings spent at the Royal Geographical Society's rooms in Queensland. He announced that he was retiring from the Imperial service, in which he had spent so many interesting years in various parts of the world. One object which lay very near his heart, and which he would like to have seen attained before leaving Queensland, was the establishment of a cosmopolitan observatory. He had been in close touch with the Senate of Harvard University, U.S.A., with regard to the suggested transference of their observatory from Arequipa, Peru, to Queensland. However, although nothing definite had come of that proposal up to the present, it was not yet off the cards, and he hoped, in the interests of astronomy as well as for the sake of Queensland, that the project yet would be carried to a successful issue. The Royal Society had the matter in hand, but he thought it not amiss to mention the matter to that kindred society. The establishment of such an institution in Queensland would give a great stimulus to the practical study of astronomy and the higher branches of mathematics generally. As for the Geographical Society's own particular sphere, he pointed out that much useful and indeed necessary work of an exploratory character yet remained to be done in this new country, and he commended to members the carrying out of such work in the near future. He was glad to know that the exploration of the Bellenden-Ker and Bartle Frere country would be commenced under the auspices of the Royal Geographical Society before long. The Great Barrier Reef also, he reminded members, offered a wonderful field for investigation. It was a reproach to Australia that another nation knew more of that famous maritime bulwark than did the country to which it geographically belonged. Concluding, His Excellency suggested that the Society should establish a scheme for instructing the members in the practical use of exploring instruments, to enable them to take astronomical observations for latitude and longitude, on the lines carried out by the parent Royal Geographical Society, London. Not the least interesting feature of the function was the presentation to Lady Goold-Adams of a pair of hatpins ornamented with Queensland gem-stones set in gold, the gift of the Council of the Society. These were handed to her Ladyship by Mrs. Lumley Hill, a Life Member of the Society, who in a neat little speech hoped that the occasion would always remind Lady Goold-Adams of her intimate association with the work of the Geographical Society. On the proposal of Dr. Thomson, Her Ladyship was elected an Honorary Member, amidst great applause. Lady Goold-Adams, in a neat and appropriate little speech, acknowledged the gift, which she would always value most highly in memory of the Geographical Society.

A most enjoyable evening terminated with a verse of the National Anthem, followed by "Auld Lang Syne." An excellent orchestra added to the agreeableness of the function.

FAREWELL ADDRESS TO THE PRESIDENT.

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

To His Excellency Major Sir Hamilton J. Goold-Adams, G.C.M.G., C.B., F.R.G.S., Fellow and President.

Your Excellency,—On behalf of the Fellows and Members of the Royal Geographical Society of Australasia, Queensland, we desire to express to Your Excellency our high appreciation of the great benefit our Society has derived under the fostering and stimulating influence of your direction as President, during the last five years, as well as of the signal services rendered to our cause by the active interest and practical sympathy at all times evinced by you in our activities and in the progress of Geographical Science at large. In giving regretful expression to our keen sense of the loss which we will sustain by your early departure from Queensland, we also earnestly desire to tender you our cordial thanks for the spontaneous manner in which you have, by your personal efforts and example, helped us in our endeavours to promote geographical knowledge. From the time we had the privilege of welcoming you as our President, on your arrival in Brisbane, some five years ago, we have recognised your exceptional claims to our regard as a geographer and traveller, and we shall always look back upon the time in which you have been so closely and actively associated with our geographical labours with feelings of pleasure and gratification. In wishing Your Excellency, Lady Goold-Adams, and Children God-speed, long life, and full measure of happiness, it is felt that, as one of our distinguished representatives, you will still continue to advance our interests in other parts of the world, and we beg to assure you that you will carry with you from the shores of Queensland our grateful remembrance and hearty good wishes for the welfare of yourself and family.

We are, Your Excellency,

Very faithfully,

Vice-Presidents.

W. F. TAYLOR J. P. WILSON.

J. P. THOMSON, Hon. Sec. and Treas.

Councillors.

James Duhig
A. J. Jones
B. L. Schooley
E. J. T. Manchester
B. Dunstan
J. A. Fraser
G. W. Whatmore
L. A. Wilkinson.

Brisbane, January, 1920.

Thirty-fifth Annual General Meeting, 24th August, 1920.

His Excellency the Rt. Hon. Sir Ronald C. Munro-Ferguson, Governor-General, P.C., G.C.M.G., LL.D., &c., Patron of the Society, in the chair.

The attendance was very large, and included Her Excellency Lady Helen Munro-Ferguson, Lady Morgan, His Grace the Most Rev. Archbishop Duhig, D.D., Mr. Justice Real, and Mrs. Real.

The minutes of the previous monthly meeting of the Society were taken as read, and duly confirmed.

The Hon. Secretary and Treasurer (Dr. J. P. Thomson) then submitted the report of Council and financial statements, duly audited. These were adopted.

The following officers and Council were then elected for the Session 1918-19:—

Patron: H.E. Rt. Hon. Sir Ronald C. Munro-Ferguson, P.C., G.C.M.G., LL.D. *Vice-Patron:* Rt. Hon. Chevalier W. M. Hughes, P.C., K.C. *President:* His Excellency Rt. Hon. Sir Matthew Nathan, P.C., G.C.M.G., F.R.G.S. *Vice-Presidents:* J. P. Wilson, Esq., Hon. W. F. Taylor, M.D., M.L.C. *Hon. Sec. and Treas.:* Dr. J. P. Thomson. *Other Members of the Council:* Most Rev. Archbishop Duhig, D.D., &c., B. L. Schooley, Esq., C.E., L. A. Wilkinson, Esq., J. A. Fraser, Esq., C.E., B. Dunstan, Esq., F.G.S., G. W. Whatmore, Esq., Hon. J. H. Coyne, M.L.A., Rev. Dr. E. N. Merrington, M.A., Ph.D., &c.

His Excellency the Governor-General then delivered the Anniversary Address.

The vote of thanks to His Excellency was moved by Mr. J. P. Wilson, seconded by His Grace Archbishop Duhig, and carried by acclamation.

Vice-President the Hon. W. F. Taylor then presented His Excellency the Rt. Hon. Sir Ronald Munro-Ferguson with the Diploma of Honorary Fellowship of the Society.

His Excellency returned thanks for the honour conferred. He then presented the Diploma of Fellowship of the Society to Messrs. F. B. C. Ford, W. M. L'Estrange, A. D. Walsh, and W. A. Wilson, all of whom made suitable acknowledgment.

On the motion of His Grace Archbishop Duhig, Her Excellency Lady Helen Munro-Ferguson was elected an Honorary Member of the Society, the Diploma being presented to Her Ladyship by Vice-President J. P. Wilson.

Her Ladyship accepted the Diploma and returned thanks.

Annual Summary, Thirty-fifth Session, 1919-20.

In laying before the Fellows and Members of the Society the Thirty-fifth Annual Summary and Financial Statement for the year ending on the 30th June, 1920, the Council is pleased to note that the Membership Roll continues to show a substantial increase of active and representative supporters, thirty new members having been elected during the session, including several ladies. This encourages the hope that during the ensuing year the ladies' representation in the activities of the Society will be greatly enlarged by the addition of many more supporters, who may find it of advantage to participate in the available privileges of membership, and thereby contribute to the advancement of geographical knowledge.

The losses by death include our greatly esteemed President, Sir Hamilton Goold-Adams, who died in South Africa on his way to England accompanied by Lady Goold-Adams and children. The melancholy news came as a great shock to our members, who, only a few weeks before, had entertained His Excellency at a Farewell Banquet, when he was presented with an address and awarded the Thomson Foundation Gold Medal. Sir Hamilton was not only one of the most active Presidents who had filled the chair of the Society, but he made valuable contributions to geographical literature, derived chiefly from his own personal observations as traveller and administrator. By his unexpected death it is felt the Society has suffered a great loss and the cause of Geography will be deprived of an active worker.

Other greatly valued members who have passed away include Mrs. Bowden, the Hons. Angus Gibson and W. Hamilton, Messrs. T. H. Brown, R. C. Lethbridge, J. H. Munro, H. I. Tubbs, and T. W. Macansh, all being highly esteemed supporters of long standing.*

The practical work of the Session included the following illustrated addresses:—

1. The Northern Coast of Queensland and the Great Barrier Reef, by Mr. W. H. D. Le Souef, C.M.Z.S., &c.
2. Irrigation and Water Conservation in Australia, by Mr. E. J. T. Manchester, M.E., &c.
3. Irrigation and Water Conservation in Queensland, by Mr. George Phillips, C.E.
4. Geological Climatic Cycles, their causes and control of Animal and Plant Life, by Prof. T. W. E. David, C.M.G., D.Sc., F.R.S.
5. A Geologist's Experience at the Western Front, by Prof. T. W. E. David, C.M.G., D.Sc., F.R.S.
6. The Pacific Islands: their Natural Wealth and Importance to Australia, by Dr. J. P. Thomson.
7. Notes on the Geology of North Queensland, by Dr. H. I. Jensen.
8. And lastly the Sessional work will be brought to a close by the Anniversary Address from His Excellency the Governor-General, the Rt. Hon. Sir Ronald C. Munro-Ferguson, P.C., G.C.M.G., LL.D., Patron of the Society.

To the authors of these valuable addresses the cordial thanks of the Society are due.

In terms of the "Constitution and Rules," the Council has conferred the Diploma of Honorary Fellowship of the Society on His Royal Highness the Prince of Wales, K.G., Vice-Patron of the Parent Society, on the occasion of the Royal visit to Brisbane, and the Prince was pleased to accept the honour. At the same time the Diploma of Honorary Fellowship was also conferred upon His Excellency the Rt. Hon. Sir Ronald C. Munro-Ferguson, P.C., G.C.M.G., LL.D., Patron of the Society, "for special and consistent interest shown in the general work of the Society and services rendered to the cause of

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* Since the close of the Session further loss has been sustained by the demise of Sir Samuel Griffith, a former distinguished President and Honorary Fellow, and the Hon. B. Fahey, pioneer colonist and greatly esteemed member.

Geographical Science.'' In this respect the Council has pleasure in recommending that the Diploma of Fellowship under subsections (*a*) and (*b*) of Section IV., Clause 3, ''Constitution and Rules,'' be also conferred upon Messrs. J. C. Cartledge, F. B. Campbell Ford, W. M. L'Estrange, J. A. Sorell, A. D. Walsh, and W. A. Wilson, all being greatly valued members of long standing.

The Council has pleasure in also recommending—

1. The suspension of so much of the ''Rules'' as provides for the payment of an entrance fee.
2. The reappointment of Mr. George Phillips, C.E., as Hon. Auditor, and Mr. H. W. Mobsby as Hon. Lanternist.
3. The reappointment of the Hon. F. T. Brentnall, M.L.C., and Mr. Alex. Muir as Hon. Members of the Council; and the appointment of Miss Dorothy Wood as Assistant Hon. Librarian.

Statement of Accounts of the Royal Geographical Society of Australasia, Queensland, from 1st July, 1919, to 30th June, 1920.

Dr.	£ s. d.	£ s. d.
By Funds at close of last Accounts—		
Balance in Government Savings Bank	..	99 13 6
Subscriptions Received	201 3 6	
President's Farewell Dinner Tickets	51 8 0	
Interest on Government Savings Bank Deposit	3 10 3	
		256 1 9
		£355 15 3

Cr.	£ s. d.	£ s. d.
To Expenditure as per Accounts—		
Gas	0 17 1	
Fire Insurance Premiums	4 17 8	
Printing and General Postage	56 7 7	
		62 2 4
Advertising Meetings	2 18 8	
Cleaning, &c.	7 4 0	
Expenses of Meetings	12 16 10	
Repairs, Additions to Furniture, Fittings, Hire of Chairs	19 14 0	
Typing and Clerical	15 7 10	
Incidentals	8 4 0	
Stationery	3 12 10	
Hon. Treasurer's Account	50 0 0	
Petty Cash	1 19 1	
Telephone Rent	7 5 5	
		129 2 8
Farewell Dinner to H.E. the President	..	51 8 0
Balance in Government Savings Bank	..	113 2 3
		£355 15 3

Examined with Vouchers, Bank Pass Book, &c., and found to be correct.

GEO. PHILLIPS, Honorary Auditor.

17th July, 1920.

Receipted by Members of Council as correct.

W. F. TAYLOR, Chairman.

20th July, 1920.

The Thomson Foundation Medal Fund.

BALANCE-SHEET AS AT 30TH JUNE, 1919.

Liabilities.

	£ s. d.	£ s. d.
The Thomson Foundation Medal Fund	..	300 0 0
Balance in Government Savings Bank on 30th June, 1918	43 18 9	
Deposit in Government Savings Bank, 1918-19 ..	6 0 0	
Interest in Government Savings Bank, 1918-19 ..	1 13 3	
		51 12 0
		£351 12 0

Assets.

Fixed Deposit in the Bank of Queensland, Limited..	..	300 0 0
Government Savings Bank	..	51 12 0
		£351 12 0

Examined with Vouchers, Bank Pass Books, &c., and found to be correct.

GEO. PHILLIPS.

12th July, 1919.

Accepted.—W.F.T. 14th July, 1919.

BALANCE-SHEET AS AT 30TH JUNE, 1920.

Liabilities.

	£ s. d.	£ s. d.
The Thomson Foundation Medal Fund	..	300 0 0
Balance in Government Savings Bank on 30th June, 1919	51 12 0	
Deposit in Government Savings Bank, 1919-20 ..	7 1 0	
	58 13 0	
Less Cost of Medals and Brokerage	56 5 0	
	2 8 0	
Interest in Government Savings Bank, 1919-20 ..	0 5 11	
		2 13 11
		£302 13 11

Assets.

Fixed Deposit in the Bank of Queensland, Limited..	..	300 0 0
Government Savings Bank	..	2 13 11
		£302 13 11

Examined with Vouchers, Bank Pass Book, &c., and found to be correct.

GEO. PHILLIPS.

17th July, 1920.

Accepted by the members of Council as correct.

20th July, 1920. W. F. TAYLOR, Chairman.

ADDRESS OF WELCOME TO H.R.H. THE PRINCE OF WALES.

To His Royal Highness, Edward Albert Christian George Andrew Patrick David, Prince of Wales, Earl of Chester in the Peerage of England, Duke of Rothesay, Earl of Carrick and Baron of Renfrew in the Peerage of Scotland, Lord of the Isles and Great Steward of Scotland, K.G., P.C., G.M.M.G., G.M.B.E., M.C.

May it please Your Royal Highness,—On behalf of the Council, Fellows, and Members of the Royal Geographical Society of Australasia, Queensland, we desire to offer you a cordial welcome to Brisbane, and to express the hope that your visit to the Commonwealth of Australia may be fraught with pleasant reminiscences to yourself and prove of lasting advantage to the Empire at large, over which the illustrious House of your forebears has so successfully reigned from the glorious Victorian Age to the present time.

In giving expression to our continued loyalty to His Majesty King George V. and the Royal Family, we remember with gratitude the encouragement given to the pursuits of Geographical Research by the late Queen Victoria, as well as by your renowned predecessors, in whose footsteps we rejoice to see you so worthily follow, to the great satisfaction of His Majesty's loyal and dutiful people.

We gladly associate ourselves with fellow citizens of this free and progressive country in extending to your Royal Highness a true Australian welcome to our sunny shores.

We sincerely trust that your sojourn in Queensland may be both pleasant and informative, and that you will carry away with you a deep impression of the unswerving loyalty of the people to the Throne and Person of His Majesty the King.

Signed on behalf of the Royal Geographical Society of Australasia, Queensland,

W. F. TAYLOR,
J. P. WILSON, } Vice-Presidents.
J. P. THOMSON, Hon. Secretary and Treasurer.

25th July, 1920.

REPLY OF H.R.H. THE PRINCE OF WALES TO ADDRESS OF WELCOME.

Parliament House, Brisbane,
29th July, 1920.

The President,

Royal Geographical Society of Australasia, Queensland.

Sir,—I am directed by the Prince of Wales to convey to you his sincere thanks for the loyal address of welcome presented by you on behalf of the Royal Geographical Society of Australasia, Queensland. His Royal Highness much appreciates your good wishes, and will be happy to convey your assurances of devotion to His Majesty the King.

I am, your obedient Servant,

G. W. M. GRIGG,
Lieut.-Colonel,
Secretary to H.R.H. the Prince of Wales.

LETTER FROM H.R.H. THE PRINCE OF WALES ACCEPTING FELLOWSHIP.

Brisbane, August 3rd, 1920.

Sir,—I am desired by the Prince of Wales to acknowledge, and to thank you for, the Diploma of Honorary Fellowship of the Royal Geographical Society of Australasia.

His Royal Highness would be glad to learn from time to time of the activities of the Society of which he has been very pleased to have become an Honorary Fellow.

Yours faithfully,

GODFREY THOMAS,

Private Secretary.

The Hon. Secretary,
The Royal Geographical Society of Australasia, Queensland.

Royal Geographical Society of Australasia,

QUEENSLAND.

Founded 1885.

THE THOMSON FOUNDATION GOLD MEDAL.

Awards.

The Thomson Foundation Gold Medal of the Royal Geographical Society of Australasia, Queensland, established in 1900 in honour of Dr. J. P. Thomson, the Founder of the Society, shall be awarded annually, or at such other times as the Council may approve, to the author of the best original contribution to Geographical Literature, provided it be of sufficient merit, approved and accepted by the Council. Special awards of the Medal may also be made from time to time to such persons as have gratuitously rendered eminent services to the Society.

The following are the names of the recipients of the Medal, the grounds of the award being noted only briefly here, but are given more fully in the "Journal," to which reference is hereafter made:—

1901—**Dr. J. P. Thomson**—for his great services to Geographical Science. *Vide Queensland Geographical Journal*, vol. xv., pp. 133-134; vol. xvi., pp. 132-135, 141-142.

1906—**Sir Hugh M. Nelson**—for his valuable services to the Society. *Vide Queensland Geographical Journal*, vol. xxi., p. 151.

1910—**Sir Arthur Morgan**—for valuable services rendered to the Society. *Vide Queensland Geographical Journal*, vol. xxv., p. 144.

1917—**Dr. Griffith Taylor**—for "Thesis on the Settlement of Tropical Australia." *Vide Queensland Geographical Journal*, vol. xxxii.-iii., p. 1.

1920—**Major Sir Hamilton J. Goold-Adams**—for valuable services to the Society as President.

DIPLOMAS OF FELLOWSHIP.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 3, Constitution and Rules (*see page 2 of cover*) :—

Honorary:

H.R.H. the Prince of Wales, K.G., etc.

*Major Sir Hamilton J. Goold-Adams, G.C.M.G., C.B., F.R.G.S.

Clifford H. Hay, Esq., M.V.O., Secretary, Premier's Department, Sydney, N.S.W.

Professor J. W. Gregory, D.Sc., F.R.S., Geological Department, University, Glasgow, Scotland.

*The Right Hon. Sir S. W. Griffith, P.C., G.C.M.G., M.A., &c.

The Right Hon. Lord Lamington, P.C., G.C.M.G., G.C.I.E, B.A., F.R.G.S., Hon. F.R.S.G.S., &c.

*The Right Hon. Sir William MacGregor, P.C., G.C.M.G., C.B., M.D., LL.D., D.Sc., Hon. F.R.S.G.S., &c.

The Right Hon. Viscount Novar of Raith, P.C., G.C.M.G., LL.D.

Under Subsections (a and b) :—

*J. R. Atkinson, Esq., L.S., J.P.
E. C. Barton, Esq., C.E.
*Charles Battersby, Esq., J.P.
*Harry Baynes, Esq., J.P.
Major A. J. Boyd
Hon. F. T. Brentnall, M.L.C.
*John Cameron, Esq., J.P.
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*R. M. Collins, Esq., J.P.
Alexr. Corrie, Esq., J.P.
*Ald. John Crase, J.P.
E. E. Edwards, Esq., B.A.
J. T. Embley, Esq., L.S.
*Robert Fraser, Esq., J.P.
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Alexander Muir, Esq., J.P.
His Excellency Hon. J. H. P. Murray, C.M.G.
George Phillips, Esq., C.E.
L. F. Schoenheimer, Esq., J.P.
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A. A. Spowers, Esq., J.P., &c.
*T. S. Sword, Esq., J.P.
James Stodart, Esq., M.L.A.
Hon. W. F. Taylor, M.D., M.L.C.
Capt. W. C. Thomson
*E. M. Waraker, Esq., J.P.
A. D. Walsh, Esq., J.P.
W. A. Wilson, Esq.
Rev. L. L. Wirt, B.D.

* Dead.

LIST OF MEMBERS.

(P) Members who have contributed papers which are published in the Society's "Proceedings and Transactions." The numerals indicate the number of such contributions.

(PP) Past President.

A dagger (†) prefixed to a name indicates a member of the Council.

Life members are distinguished thus (*).

Should any error or omission be found in this list, it is requested that notice thereof be given to the Hon. Secretary.

Foundation Members:

P1 Allardyce, His Excellency Sir Wm. L., K.C.M.G., Govt. House, Hobart, Tasmania.

Alton, R., Brisbane.

Armour, R. L., J.P., Brisbane.

P1 Atkinson, J. R., L.S., Ipswich.

Bailey, T. S., Survey Department, Brisbane.

P1 Bartley, N., Brisbane.

Bell, W., Supreme Court, Brisbane.

P1 Bennett, E. J., Survey Department, Brisbane.

Brydon, J. M., J.P., Brisbane.

Coghlan, J., Mount Eagle, Cooyar.

Daniell, E. N., Survey Department, Brisbane.

Davidson, W. M., Deputy Surveyor-General, Brisbane.

Drury, E. R., C.M.G., General Manager, Q.N. Bank, Brisbane.

Ferguson, J., J.P., Brisbane.

Foxton, Hon. J. F. G., Brisbane.

Fraser, T., L.S., Brisbane.

Gailey, R., J.P., Brisbane.

P9 PP Gregory, Hon. Sir A. C., K.C.M.G., M.L.C., F.R.G.S., &c., Brisbane.

Heath, G. P., J.P., Comm. R.N., Brisbane.

Heeney, F. X., J.P., Lands Department, Brisbane.

P1 Hennessy, Capt. J. M., New Guinea.

Hoggan, R., B.A., Survey Department, Brisbane.

P1 Hull, A. A., L.S., Survey Department, Brisbane.

Langford, W. H., Survey Department, Brisbane.

Lavarack, Major C. W., Survey Department, Brisbane.

P1 Leonard, G. A., L.S., Yorick Club, Collins Street, Melbourne.

List of Members—*continued.*

Lilley, Hon. Sir Charles, Kt., Chief Justice, Brisbane.

Lloyd, W. M., J.P., Brisbane.

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Macpherson, Hon. P., M.L.C., Brisbane.

Marks, Hon. C. F., M.D., M.L.C., Fellow, Wickham Terace, Brisbane.

McDonald, G. T., L.S., Rocklea.

McDonnell, E., J.P., Brisbane.

McDonnell, J., J.P., Brisbane.

McMaster, J., M.L.A., Brisbane.

Mein, His Honour Mr. Justice C. S., M.A., Brisbane.

P2 PP Miskin, W. H., Brisbane.

P1*Moore, T. B., F.R.S., Tas., New Norfolk, Tasmania

Morehead, Hon. B. D., M.L.A., Brisbane.

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Muir, J., J.P., Brisbane.

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Raff, H., L.S., Brisbane.

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Ryan, R. A., J.P., Brisbane.

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P1 PP Stodart, J., Fellow, Market Street, Brisbane.

Thomson, John, M.B, &c., Brisbane.

P40 PP†Thomson, J. P., C.B.E., LL.D., Hon. F.R.S.G.S., &c., Hon. Sec. and Treasurer, Brisbane.

Trower, H., Survey Department, Brisbane.

Tully, W. A., B.A., F.R.G.S., Surveyor-General, Brisbane.

Viner, A. J., Brisbane.

P1 PP Waugh, J. N., M.D., Brisbane.

Williams, W., J.P., Brisbane.

Wilson, R. W., J.P., Brisbane.

Wilson, W. H., Brisbane.

P1 Woolnough, Rev. G., M.A., Brisbane.

Wright, H. T., Comm. R.N., Brisbane.

LIST OF MEMBERS—*continued.*

Members.

Adamson, Senator Hon. John, C.B.E., Hendra, Brisbane.

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Allan, David Muir, Engineering Supply Co., Ltd., Edward Street, Brisbane.

Allan, Dr. R. M., M.C., Wickham Terrace, Brisbane.

Allom, C. V., c/o B.P. and Co., Brisbane.

Allom, S. R. F., F.F.I.A., F.C.P.A., 268 Edward Street, Brisbane.

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*Barrett, Mrs. Walter, Eagle Junction, Brisbane.

P1 Barton, E. C., F.R.G.S., M.I.E.E., F.R.M.S., Ipswich Electric Light Co., Boundary Street, Brisbane.

Beck, John George Henry, J.P., Morton Street, Eidsvold, Q.

Beirne, Hon. T. C., M.L.C., Brunswick Street, Valley, Brisbane.

Bell, E. T., M.L.A., Coochin Coochin, Queensland.

Bell, V. D., Coochin Coochin, Queensland.

Bird, J. T. H., Public Works Commission, Treasury Buildings, Brisbane.

Blackman, A. H. ————

Borton, Mark W., Land Commissioner, Toowoomba, Queensland.

Bourne, Dr. H. T., Red Hill, Brisbane.

P2 Boyd, Major A. J., FELLOW, Dept. of Agriculture and Stock, Brisbane.

P4 PP†Brentnall, Hon. F. T., M.L.C., FELLOW, ''Eastleigh,'' Coorparoo, Brisbane.

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Buchanan, A. J., M.A., LL.B., ''Midnight Sun'' Office, Melbourne, Victoria.

Bull, Arthur, ————

Bunning, G. E., J.P., ''Tarong,'' Blakeney Street, South Brisbane.

Burtt, Frank, Secy., Outridge Printing Co., Ann Street, Brisbane.

Butler, John Henry, Messrs. Butler Bros., Charlotte Street, Brisbane.

Calvert, Thomas, J.P., Box 67, Proserpine, Q.

*Cameron, Pearson Welsby, J.P., Nicholas Street, Ipswich, Q.

Campbell, G P., J.P., Messrs. Jas. Campbell and Sons, Ltd., Creek Street, Brisbane.

Campbell, Victor F. J., Messrs. Jas. Campbell and Sons., Ltd., Creek Street, Brisbane.

*Campbell, A., J.P., Glengyle Station, Birdsville, Queensland.

Cannon, D., ''Como,'' Yeronga, near Brisbane.

Cartledge, John Colenso, FELLOW, 246 Umbila Road, Durban, Natal, S. Africa.

Carvosso, William Henry, J.P., Sheriff and Marshal, Supreme Court, Brisbane.

LIST OF MEMBERS—*continued.*

Cobden, Richard, Brisbane Club Chambers, Adelaide Street, Brisbane.
Colclough, E., Lands Department, Brisbane.
*Collins, Mrs. R. M., "Tamrookum," Beaudesert, Queensland.
Colman, G. S., Q.M.E. Co., Mary Street, Brisbane.
Corlass, E. J., "Wyuna," Ormand Street, Ascot, Brisbane.
*Corrie, Alex., J.P., FELLOW, "Parbury House," Eagle Etreet, Brisbane.
Coutts, J. V. D., Union Bank Chambers, Brisbane.
†Coyne, The Hon. J. H., M.L.A., Minister for Lands, Lands Department, Brisbane.
*Crorkan, T., J.P., ———
Crowe, Dr. P. F. V., 628 Ann Street, Brisbane.
Crowther, A. J., General Manager, Railway Department, Townsville, Q.
Crowther, S., J.P., "Beechfield," Dornoch Terrace, South Brisbane.
P1 Cummins, J. J., Authorised Surveyor, c/o Survey Office, Brisbane.

De Conlay, James, J.P., Warwick, Q.
Doggett, Ald. Harry, J.P., 35 Arthur Street, Fortitude Valley, Brisbane.
Down, Alderman G., J.P., Ward's Chambers, Queen Street, Brisbane.
Drewe, A. W., Q.M.E. Co., Mary Street, Brisbane.
Duhig, Dr. J. V., Wickham Terrace, Brisbane.
†Duhig, His Grace the Most Rev. Archbishop, D.D., "Dara," Brisbane.
†Dunstan, Benjamin, F.G.S., Govt. Geologist, Brisbane.

Eden, Mrs. D. R., 194 William Street, Brisbane.
P1 Edwards, Edward E., B.A., FELLOW, Telegraph Building, Brisbane.
Effey, William, J.P., Central Buildings, Edward Street, Brisbane.
Elliott, Eric, Messrs. Elliott Bros., Eagle Street, Brisbane.

Fairfax, J. Hubert, J.P., "Marinya," Cambooya, Q.
Fish, George, J.P., 46 Grey Street, South Brisbane.
Fisher, Rt. Hon. Andrew, P.C., High Commissioner for Australia, London, England.
FitzGerald, C. A., c/o City Electric Light Co., Boundary Street, Brisbane.
*Foot, J. A., J.P., Warrinilla, Rolleston, Queensland.
P1 Ford, F. B. Campbell, FELLOW, Deputy Surveyor-General, Brisbane.
Forsyth, James, M.L.A., "Braelands," South Toowong, Brisbane.
Foster, A. T., Norman Crescent, Norman Park, East Brisbane.
Fox, C. B., Messrs. Nicol Robinson, Fox, and Edwards, Solicitors, Queen Street, Brisbane.
Frankel, Philip, J.P., "Zonoma," Mark Street, New Farm, Brisbane.
†Fraser, J. A., C.E., Deputy Chief Engineer, Railway Department, Brisbane.
Fraser, Captain C. Sankey, Edward Street, Brisbane.
Freeleagus, C., Consul for Greece, Freeleagus Chambers, Edward Street, Brisbane.

LIST OF MEMBERS—*continued.*

Gibson, D. W., Authorised Surveyor, c/o Survey Office, Brisbane.

Gilchrist, E. F., B.A., M.C.E., City Engineer, Brisbane.

Gillies, R. G., J.P., City Printing Works, Elizabeth Street, Brisbane.

Goodman, George, Alfred street, Charleville, Q.

Gorringe, J. A., Authorised Surveyor, Kempton, Tasmania.

Graham, Mrs. Thos., Northern Territory.

Green, H., ''Avoca,'' Yeronga, Brisbane.

Greene, Miss Alice J. Alison, Principal, Moreton Bay Girls' High School, Wynnum.

Greene, Alderman S., Wynnum, Queensland.

Greenham, Dr. Eleanor Constance, Edward Street, Brisbane.

Greensill, E. H. R., C.E., Authorised Surveyor, Chief Engineer's Department, Railway Offices, Brisbane.

Grey, Mrs. J. R., Hotel on Diadeine, Papeete, Tahiti.

Griffin, William Charles, J.P., Somerset Farm, Gordon Vale, near Cairns, Q.

Grimes, W. D., ''Tarragindi,'' Cracknell Road, South Brisbane.

Gunn, Donald, M.L.A., Parliament House, Brisbane.

Hall, Thomas, Annerley Road, South Brisbane.

Hall, T. R., Architect, Kodak Building, Queen Street, Brisbane.

Hannaford, S., J.P., ''Utopia,'' Stanthorpe, Queensland.

Harbord, H. H., J.P., Maytown, Queensland.

*Hart, J. H., ''Culterfel,'' Manly, Queensland.

Haviland, C. V., Govt. Land Buyer, Port Moresby, Papua.

Henderson, G., J.P., ''Elmbank,'' Laidlaw Parade, East Brisbane.

Hertzberg, A., Messrs. A. M. Hertzberg and Co., Charlotte Street, Brisbane.

Hertzberg, Marcus, B.A., LL.B., Messrs. A. M. Hertzberg and Co., Charlotte Street, Brisbane.

Hetherington, Alderman J. W., J.P., Main Street, Kangaroo Point, Brisbane.

Hicks and Co., Limited, John, The Manager, House and General Furnishers, George Street, Brisbane.

*Hill, Mrs. Lumley, Belle Vue House, Bellevue, Q.

Hillcoat, Reginald E. R., J.P., Teneriffe House, Teneriffe, Brisbane.

*Hodel, F. C., J.P., Cairns, Queensland.

Holmes, E. J., J.P., Messrs. Holmes and Church, Queen Street, Brisbane.

*Holt, W. H., F.R.C.I., ''Glanwyne,'' Manly Point, Manly, N.S.W.

Pl*Horton, Leonard Cecil, J.P., FELLOW, ''The Gunyah,'' Johnstone River, Q.

Huxham, The Hon. J., M.L.A., Dept. of Public Instruction, Brisbane.

Illingworth, W. E., Messrs. A. M. Hertzberg and Co., Charlotte Street, Brisbane.

LIST OF MEMBERS—*continued.*

Irving, J. Washington, M.R.C.V.S.L., Ann Street, Brisbane.

Irving, W. Edmund, "Lorina," Kirkland Avenue, Coorparoo, Brisbane.

P2 Jensen, Dr. H. I., Geological Survey Office, Brisbane.

Jensen, Thor. H., Authorised Surveyor, Treasury Chambers, George Street, Brisbane.

Johnson, William Guard, J.P., Palmerin Street, Warwick, Q.

Johnston, Robert Henderson, F.V.C.M., F.I.G.C.M., Limestone Hill, Ipswich, Q.

Jones, Arthur, senr, J.P., Bondoola, *viâ* Rockhampton, Queensland.

Jones, Hon. T. L., M.L.C., Messrs. Foggitt and Jones, Turbot Street, Brisbane.

Jordan, Rev. Father M., Presbytery, Nundah, Q.

Joyce, R., 228 Elizabeth Street, Brisbane.

Just, John Stephens, City Electric Light Co., Boundary Street, Brisbane.

Kennedy, A. S., FELLOW, Kingsholme, Fortitude Valley, Brisbane.

Key, W. F. S., Home Secretary's Office, Brisbane.

Kirkaldy, John, J.P., Lorraine, Cloncurry, N.Q.

Leahy, Hon. P. J., M.L.C., 293 Queen Street, Brisbane

Le Souef, W. A. Dudley, C.M.Z.S., M.B.O.U., FELLOW, Royal Park, Melbourne, Victoria.

L'Estrange, W. M., M.I.E.E., FELLOW, G.P.O., Box 546, Brisbane.

Lethem, C. B., C.E., FELLOW, Clayfield, Brisbane.

Lewis, A. A., J.P., ————

Loughran, E., Springsure, Q.

Macdonald, Hamilton, and Co., The Manager, Mary Street, Brisbane.

Macdonald, John, J.P., Union Bank Chambers, Queen Street, Brisbane.

Macintosh, T. B., J.P., Woollogorang, Northern Territory, Burketown, Queensland.

Macleod, N. J., J.P., Registrar-General, Treasury Buildings, Brisbane.

Macrossan, H. D., B.A., Barrister, Lutwyche Chambers, Adelaide Street, Brisbane.

Manchester, E. J. T., M.E., &c., President Metropolitan Water and Sewerage Board, Brisbane.

McArthur, Robert, District Engineer's Office, Maryborough, Q.

McConachie, J., Postal Department, Brisbane.

*McDonald-Terry, A. J., J.P. ————

McGrath, W. J., "Truth" Building, Queen Street, Brisbane.

McIntosh, Dr. (Col.) A. M., P.M.O., Clayfield, Brisbane.

McIver, Miss Nell, The University, Brisbane.

McKenna, Dr. T. R., "Namoi," Norman Parade, Eagle Junction, Brisbane.

LIST OF MEMBERS—*continued.*

McKenzie, John A., Manager, Messrs. Robert Reid and Co., Limited, 144-146 Edward street, Brisbane.

McLeod, Alex., J.P., Elizabeth Street, Brisbane.

McLeod, J. J. W., ''Terranora,'' Windermere Road, Hamilton, Brisbane.

McWilliam, T. M., Manager, Messrs. Brabant and Co., Charlotte Street, Brisbane.

P1 McMahon, Thos. J., FELLOW, c/o V. Yabsley, Esq., Bank of Australasia, Martin Place, Sydney, N.S.W.

Menzies, A. R., D.D.S. (Penn.), L.D.S., R.C.S. (Edin.), L.D.S.Q., 63 Queen street, Brisbane.

†Merrington, Rev. E. N., M.A., Ph.D., Mowbray Street, East Brisbane.

Micheli, J., Sandgate, Q.

Mobsby, H. W., F.R.S.A., FELLOW, Hon. Lanternist, Department of Agriculture and Stock, William Street, Brisbane.

Moore, D. J. I., Commissioner for Public Health, Brisbane, or Wynnum.

Moran, H. S. F., Dental Surgeon, A.M.P. Buildings, Brisbane.

Morgan, Dr. T. H., ''Milford,'' Wickham Terrace, Brisbane.

Moss, R. D., Messrs. Dalgety and Co., Elizabeth Street, Brisbane.

Mottershead, A., B.A., B.Sc., Church of England Grammar School, Brisbane.

Moxon, W. E., Adelaide S.S. Co., Queen Street, Brisbane.

Mullins, James, c/o Mrs. Tinline, No. 1 Woodbine Avenue, Greenlane, Auckland, New Zealand.

*Munro, E., ''Darloo,'' Albion, Brisbane.

Murphy, The Hon. Peter, M.L.C., Hamilton, Brisbane.

Murray, His Excellency, Hon. J. H. P., C.M.G., FELLOW, Lieut.-Governor, Port Moresby, Papua.

Murray, Mrs. John, ''Tullibardin,'' New Farm, Brisbane.

Nally, P. J., Intelligence and Tourist Bureau, Brisbane, Q.

Nathan, His Excellency Rt. Hon. Sir Matthew, P.C., G.C.M.G., F.R.G.S., President, Government House, Brisbane.

Needham, F. H., J.P., 37 Marlborough Street, Drummoyne, Sydney, N.S.W.

Nicholas, C. E., J.P., ''Highlands,'' Samford, Queensland.

Rt. Hon. Viscount Novar of Raith, G.C.M.G., Patron, Kirkcaldy, Scotland.

O'Hara, R. E., J.P., New Park, Ballymoch, County Sligo, Ireland.

O'Reilly, Charles, J.P., Dornoch Terrace, South Brisbane.

Paine, A. A., J.P., ''Illalong,'' Brandon, *viâ* Townsville, Queensland.

Parker, William Richard, L.D.S., Eng., dentist, Edward Street, Brisbane.

LIST OF MEMBERS—*continued.*

Parkinson, F. C., Elizabeth Street, Brisbane.

Paul, G. W. F., M.D., Main Street, East Brisbane.

Paull, S. P., Queensland Novelty Company, Elizabeth Street, Brisbane.

Peart, John, C.E., M.I. Mech. E. (Lon.), Engineer for Water Supply, Metropolitan Water and Sewerage Board, Brisbane.

Perrett, Arthur, J.P., Kaboonga, Kinbombi, Q.

*Perry, G. H., J.P., c/o Messrs. Perry Brothers Ltd., Elizabeth Street, Brisbane.

*Philp, Hon. Sir Robert, K.C.M.G., Toowong, Queensland.

Phipps, J. H., King Street, East Brisbane.

*Plant, Col. C. F., F.R.A.S., J.P., "Ferndale," Ashgrove, near Brisbane.

Poole, Miss C., c/o "Menzies," George Street, Brisbane.

Purkiss, L. D. M., New Zealand Insurance Co., Brisbane.

Pound, C. J., F.R.M.S., Yeerongpilly, Brisbane.

Quaid, J. D., J.P., "Ahillon," River Bank, Hill End, South Brisbane, Queensland.

Raymond, Ald. A. J., J.P., 178 River Terrace, Kangaroo Point Brisbane.

Real, His Honour Mr. Justice, Coorparoo, Brisbane.

Reid, P. E. A., J.P., Queensland National Bank, Limited, Charters Towers, Q.

Rice, Thos., "Fernlea," Kingley Terrace, Manly, Q.

Richard, Captain G. A., "Kinellan," New Farm.

Robertson, Henry, J.P., "Harelvyn," Abbott Street, New Farm, Brisbane.

Robertson, Dr. (Major) W. N., C.B.E., 69 Wickham Terrace, Brisbane.

Rudd, William Henry, J.P., Messrs. Walter Reid and Co., Rockhampton, Q.

Ruthning, A. F. T., Solicitor, Lutwyche Chambers, Adelaide Street, Brisbane.

†Schooley, B. L., C.E., International Well Boring Co., Ann Street, Brisbane.

Scott, Dr. E. W. Kerr, Brunswick Street, Brisbane.

Seabrook, George Kenilworth, J.P., F.R.C.I., 42 Adelaide Street, Brisbane.

Sexton, R. E., C.E. (Chief Engineer), Central Railway Offices, Brisbane.

Shackel, T. W., F.S.S., Thorn Street, Kangaroo Point, Brisbane.

Shaw, Dr. Helen, Sherwood Lodge, Toowong, Brisbane.

*Shepherd, Arthur, J.P., Milray Station, Pentland, N.Q.

Simmons, Langley, Indooroopilly, Queensland.

Slade, W. B., J.P., East Glengallon, Warwick, Q.

Smith, H. F., J.P., Queen and George Streets, Brisbane.

LIST OF MEMBERS—*continued.*

P1 Sorrell, John Arnold, FELLOW, Staff Surveyor, Rockleigh, Wagga Wagga, N.S.W.

Spence, Lockhart Horsburgh, J.P., Managing Director, E. Rich and Co., Brisbane.

Sperling, C. D., ''Mayfair,'' Edward Street, Brisbane.

P1 PP Spowers, Allan A., FELLOW, Surveyor-General, Executive Building, Brisbane.

Steele, E., Stainburn Downs, Aramac, Queensland.

Steele, J. D., J.P., Authorised Surveyor, Department of Public Lands, Brisbane.

Stephens, Hon. Wm., M.L.C., ''Waldheim,'' Ipswich Road, South Brisbane.

*Stevens, Hon. E. J., M.L.C., Southport, Queensland.

Stirling, A. C., C.E., District Engineer, Mirinda, *viâ* Bowen, Q.

Svensen, Captain O., ''Norway,'' Galloway's Hill, Norman Park, Brisbane.

Taylor, E., J.P., Messrs. Taylor and Colledge, Ltd., Wholesale Chemists, Charlotte Street, Brisbane.

†Taylor, Hon. W. F., M.D., M.L.C., FELLOW, &c., Vice-President, Preston House, Queen street, Brisbane.

Taylor, Capt. R. S., Assoc. I.N.A., Lloyd's Surveyor, Eagle Street, Brisbane.

Taylor, T. McI., Manager, Moreheads Ltd., Brisbane.

Theodore, Hon. E. G., M.L.A., Premier, Bowen Terrace, Brisbane.

The Bodleian Library (The Librarian), University of Oxford, England.

Thompson, Dr. Robert, ''Bunya Bunya,'' Wickham Terrace, Brisbane.

P5 Thomson, Capt. W. C., FELLOW, ''Loma Langi,'' Ascot, Brisbane.

Tritton, F., George Street, Brisbane.

Tryon, Henry, Government Entomologist and Vegetable Pathologist, Department of Agriculture and Stock, Brisbane.

Waddell, W. A., J.P., Koorboora, *via* Cairns, Queensland.

Walsh, A. D., J.P., FELLOW, General Manager, Messrs. Dalgety and Co., Elizabeth Street, Brisbane.

Walsh, J. A., Messrs. Fitzgerald and Walsh, Queen Street, Brisbane.

Warren, C. C., 24 Wharf Street, Brisbane.

Watts, J., J.P., Corinda, near Brisbane.

*Weedon, W., Selby House, Wickham Terrace, Brisbane.

*Weedon, H. S., C.E., L.S., Box 44, G.P.O., Sydney, N.S.W.

†Whatmore, G. W., Director and Manager, Queensland Motor Agency, Adelaide Street, Brisbane.

*Whittingham, Hon. Arthur Herbert, M.L.C., ''Mayfield,'' Hamilton, Brisbane.

LIST OF MEMBERS—*continued.*

†Wilkinson, L. A., Chemist, Queen and George Streets, Brisbane.

Williams, W. W., Land Commissioner, Cloncurry.

†Wilson, John P., J.P., Vice-President, 85 Edward Street, Brisbane.

Wilson, W. A., J.P., FELLOW, Flinders Parade, Sandgate.

Wilson, A. W., J.P., General Agent, Charters Towers, Q.

Winnett, W. G., Slack's Creek, Kingston, Queensland.

Wood, Miss Dorothy M., Box 531, G.P.O., Brisbane.

Honorary Members.

H.H. Prince Roland Bonaparte, 10 Avenue d'Iena, Paris, France.

Professor Sir T. W. E. David, K.B.E., C.M.G., D.Sc., F.R.S., University, Sydney, N.S.W.

Lady Goold-Adams.

F. W. Gregory, Sydney, N.S.W.

J. B. Henderson, M. Inst. C.E., Hawthorn, E. Brisbane.

P1 The Right Hon. Lord Lamington, P.C., G.C.M.G., G.C.I.E., B.A., F.R.G.S., Hon. F.R.S.G.S., &c., Lamington, Lanarkshire, Scotland.

Lady Morgan, Mia Mia, Foxton Street, Indooroopilly, Brisbane.

Lady Nelson, ''Gabbinbar,'' Toowoomba, Q.

Lady Norman, London, England.

Viscountess Novar of Raith, Kirkcaldy, Scotland.

P7 George Phillips, C.E., FELLOW, Hall Street, Alderley, Q.

Honorary Corresponding Members.

Cyrus C. Adams, F.A.G.S., Editor Bulletin of the American Geographical Society, Broadway, at 156th Street, New York City, U.S.A.

P2 His Excellency Sir W. L. Allardyce, K.C.M.G., Government House, Hobart, Tasmania.

P2 Dr. J. V. Danes, Consul-General, Czechosiovak Republic, Sydney, N.S.W.

P1 Professor Richard Elwood Dodge, Teachers' College, Columbia University, New York City, U.S.A.

Dr. Karel Domin, Asst. Professor of Botany, Bohemian University, Prague.

His Honour Dr. W. F. Frear, 303 Stangenwald Buildings, Honolulu, Hawaiian Islands.

Very Rev. D. M. Gordon, C.M.G., M.A., D.D., LL.D., Principal Emeritus, Queen's University, Kingston, Ontario, Canada.

Hon. W. T. Harris, Ph.D., LL.D., late Commissioner of Education, Washington, D.C., U.S.A.

The Hon. W. A. Holman, Ex-Premier of New South Wales, Northfield Chambers, Phillip Street, Sydney.

LIST OF MEMBERS—*continued.*

Sir G. R. Le Hunte, K.C.M.G., Steepleton Manor, Dorchester, Dorset, England.

Sir J. Scott Keltie, LL.D., Editor Statesman's Year Book, &c., Royal Geographical Society, Kensington Gore, London, S.W., England.

P2 R. H. Mathews, L.S., Associé étranger Soc. d'Anthrop de Paris; Corr. Memb. Anthrop. Soc., Washington; Corr. Memb. Anthrop. Soc., Vienna; Local Correspondent for Australia, Royal Anthrop. Inst. London; "Carcuron," Hassall Street, Parramatta, N.S. Wales.

Cathcart, William Methven, M. Inst. C.E., F.R.S.E., F.R.I.B.A., Club Arcade, Durban, South Africa.

P3 H. R. Mill, LL.D., D.Sc., F.R.S.E., F.R.G.S., F.R.S.G.S., Hill Crest, Dorman's Park, Surrey, England.

Dr. Eric Mjöberg, Director Deli Experiment Station, Sumatra.

Rev. Dr. E. F. Pigot, S.J., Science Master and Director of the Observatory, Riverview College, Sydney, N.S.W.

P3 Captain J. F. Ruthven, R.N.R., F.R.G.S., Junior Carlton Club, Pall Mall, London, S.W.

P1 S. P. Smith, F.R.G.S., New Plymouth, New Zealand.

Frederick Stubbs, F.R.G.S., Rotorua, New Zealand.

Mrs. J. P. Thomson, Laidlaw Parade, East Brisbane.

Rt. Rev. Gerard Trower, D.D., Bishop of North Australia, Port Darwin.

APPENDIX I.

Royal Geographical Society of Australasia, Queensland.
Special Meeting and Conversazione.

29th November, 1920.

This was a Special Meeting and Conversazione arranged by the Vice-Presidents and Council ''For the purpose of marking the honour bestowed upon the Royal Geographical Society of Australasia, Queensland, by His Majesty the King, in creating the Founder and Honorary Secretary, Dr. J. P. Thomson, a Commander of the Order of the British Empire (C.B.E.).

The chair was occupied by the Senior Vice-President, the Hon. W. F. Taylor, M.D., M.L.C., supported by Vice-President Mr. J. P. Wilson, and His Grace the Most Rev. Archbishop Duhig, D.D.

There was a large and representative attendance of the Members and their friends, including Lady Morgan and other ladies.

In opening the proceedings the Chairman (Hon. W. F. Taylor, M.D., M.L.C.) said:

Ladies and Gentlemen,—We have been called together this evening for the purpose of receiving the announcement of the honour which has been conferred on this, the Royal Geographical Society of Australasia, Queensland, by His Majesty the King, through its Founder and Honorary Secretary, Dr. James Park Thomson, who has been created a Commander of the Order of the British Empire. Having had brought under his notice the work done by the Society in the advancement of Geographical Science, not only in the State of Queensland, the Commonwealth of Australia, and the Dominion of New Zealand, but also throughout Europe and America, by means of the circulation of its journal and correspondence, etc., His Majesty has been pleased to mark his approval of the efforts of the Society in this direction by bestowing a high distinction on one who, according to the Society's records, has been mainly instrumental in bringing it to its present state of importance and usefulness.

As many of our newer members may possibly not be fully cognisant of the high standard of work done by the Society since its inception, and as some of the older ones may have partially forgotten, in the lapse of time, much that it has done in the past, I would like, with your permission, to refer to some of the most important of its activities during the time of its somewhat extended existence of thirty-five years.

The Society was inaugurated in the year 1885, the first President being the Hon. A. C. Gregory, C.M.G., who held office for three years. He was followed by Dr. Waugh, Mr. Miskin, and Sir Samuel Griffith, each holding office for one year, when Mr. Gregory was again elected President, and held office for two consecutive years. Dr. J. P. Thomson then assumed the presidency, holding it from 1894 to 1897, the two years' limit of tenure of office of president being suspended to permit of Dr. Thomson holding the chair for the third term. He was followed by Mr. Wm. Allan and Mr. R. M. Collins, who respectively held office for one year. Then came Sir Hugh Nelson, who was President from 1899 to 1905, and after him came Lord Chelmsford, who held office from 1905 to 1909. Sir Wm. MacGregor followed for a short period, and was succeeded by Sir Arthur Morgan, who held office for two years. Then came Mr. A. A. Spowers, the Hon. F. T. Brentnall, Mr. J. Stodart, and the Hon. J. W. Blair, each holding office for one year, and finally Sir Hamilton

Goold-Adams, the late Governor of Queensland, who was President of the Society from the year 1915 to the date of his death this year; and now Sir Matthew Nathan, the Governor-elect of Queensland, holds the position of President of the Society.

On an average ten papers per annum have been read before the Society, and most of them have been published in its Journal of Proceedings and Transactions.

The office of Patron of the Society has been held by distinguished men, including the late Sir Henry Wylie Norman, the Viceroy of India, Lord Chelmsford, and for the last six years the Governor-General of Australia, Sir Ronald Munro-Ferguson, who has recently been created a Viscount for his services as Governor-General of Australia during the trying period of the Great War. I am sure that I may affirm that we all join in heartily congratulating our highly distinguished Patron on the well-merited honour that His Majesty the King has conferred upon him, and hope that he may live long to enjoy it.

With such a galaxy of distinguished men intimately connected with the Society it became necessary to justify such connection by the quality of the work done by its members, and to the Founder and Honorary Secretary of the Society the lion's share of that work has fallen. He has faithfully performed his task, and has done so under difficulties which no one but himself is fully aware of. The infant Society that he launched upon the scientific world required careful nursing during the first few years of its existence, and this he bestowed upon it with loving skill and tenderness, often at the cost of time and attention which were due to his family and private affairs. The Society was practically without any habitation for the first nine years of its existence, and the secretarial work, and the editing of Journals of the Transactions of the Society, had to be done by Dr. Thomson at his own house; and the library, which rapidly increased in size, and the maps, etc., had to be accommodated in his private residence, much to the inconvenience of himself and his wife and family. But he was determined to make the Society a real, living activity, and by his earnestness, enthusiasm, and untiring energy he secured the hearty co-operation in the work of the Society of Sir Anthony Musgrave, Sir Henry Norman, Lord Lamington, Sir Wm. MacGregor, as Patrons of the Society, as well as other gentlemen well known for their scientific knowledge, and geographical and astronomical research—notably the present Patron, the late Governor-General of Australia, Viscount Novar of Raith.

Some idea of the magnitude of the work done by the Society, and its value, may be gathered from the fact that on an average ten papers each year have been read before the Society, and published in its Journal of Transactions and Proceedings, and that it exchanges its Journal with that of every kindred Society in Europe, Asia, and North and South America. The high scientific nature of its work may be gauged by the titles of the papers read at its meetings, and from the names of the authors of such. Foremost among the contributors of papers imparting valuable information is Dr. Thomson (a list of the papers read by him before the Society, as well as those furnished other similar societies and newspapers, etc., up to the year 1907, appears in the ''Summary of the Geographical Work of J. P. Thomson, LL.D., Hon. F.R.S.G.S. (Edinburgh),'' printed and published by the Society).

Amongst the honours conferred on him may be mentioned:—Peek Award

Recipient of the Royal Geographical Society, London; Special Foundation Gold Medalist; an Hon. Vice-President 6th International Geographical Congress, London; Hon. Corresponding Member of these Societies—New York Academy of Sciences; the Sociedad Cientifica "Antonio Alzate," Mexico; the Verein fur Erdkunde zu Halle; the Royal Scottish Geographical Society; the Manchester Geographical Society; the Societe de Geographie Commerciale de Paris; the Societe de Geographie de Marseille, etc.

Twenty or thirty other publications should be added to this list to make it complete (probably 150 works altogether), and since 1907 many other publications by Dr. Thomson have appeared; so that we have in Dr. Thomson a storehouse of scientific information which he has freely and liberally given to the world at large. From such a wealth of informative matter it is difficult to make a selection by way of illustration, as it is all equally good, but I think that Dr. Thomson's pronouncement as to the scope of Geography will appeal to you as it does to me, so I will read that portion of his Presidential Address delivered in the Session 1895-6 which deals with the subject*:—

"THE SCOPE OF GEOGRAPHY

is the next subject to which I desire to draw attention. Regarded as one of the richest—one of the most essential departments of human knowledge—geography covers an enormously large field of investigation. It is a department with specialised subdivisions representing sections for the study of such highly important and practical subjects as the Land, the Sea, the Air—the Conditions of Animal and Vegetable Life—Man and his Environment—Historical Geography, Geographic Art (Cartography), the Geography of Commerce, Political Geography, and Astronomical Geography. To study these satisfactorily it is necessary to possess a deep and comprehensive knowledge of the world as a whole; an adequate conception of its place in the universe, the position it occupies in the economy of nature; the structural elements of the earth and their combination; a just conception of its motions, the laws by which they are regulated, as well as the natural course and order of these laws. If we are to accept the simple definition of the somewhat loosely applied term 'science,' as knowledge systematised, it must necessarily follow that the systematic study and investigation of geographical knowledge, in the widest acceptation of that term, will lie along clearly defined lines of scientific inquiry; —that, in point of fact, geography is one of the most fertile and stimulating departments of human knowledge, and one with long and widely expanding avenues for the application and free exercise of intellectual power. In its physical aspect it deals, broadly speaking, with the various configurations of land forms, their structure and changes, and the phenomena by which these changes are produced. In relation to the sea, geography, or oceanography, concerns itself with the configuration and contours of the submerged areas of the earth's crust, with ocean depths, currents, tides, and the salinity of the waters. In the succeeding department the conditions of the air receive consideration, atmospheric phenomena are recorded, climatic conditions are investigated, and their influence on man and other forms of life studied. The next subdivision appeals directly to human sympathy; of all the sections of our subject this is perhaps the most vital, because it identifies itself with man and his environment; the distribution of the race; the influence of physical

* Session 1895-6, vol. xi., page 142, "The Scope of Geography."

conditions and surface configurations of land forms in the production or modification of racial distinctions, peculiarities, and mode of life; man's place in the economy and realm of nature, and the distribution of other forms of animal and vegetable life. The historical division inquires into and records the history and exploration and discovery, the achievements of men distinguished by their labours in this department of human knowledge, geographical events in the life history of the race and of the world, and the history of cartography. The subject of geographic art is studied by cartographers or professional geographers who devote special attention to the art of map-making; it is an interesting, important, and skilled branch of the science, and one in which special training is required. Commercial or economic geography appeals more directly, perhaps, to the practical phase of life than any of its preceding co-sections; its ramifications are enormous and far-reaching, extending as they do to all parts of the earth inhabited by or accessible to man. It deals with the production, manufacture, exchange, and consumption of human commodities; the opening up of new markets; the development of the natural and artificial resources and enterprise in new and foreign countries; the extension of trade routes and the great commercial highways, besides foreign exchange, language, habits and customs, forms of government and other national considerations. The political section devotes itself to the conisderation of domestic and foreign policies and relations, and to the permanence, position, and delimitation of national and other boundaries, whether natural or artificial. It is an important branch, and one requiring a wider knowledge of the principles of geography, especially the physical aspect, and their closer study, than they usually receive. The astronomical division, as its name implies, associates itself with that branch of practical astronomy applied in the determination of positions on the earth's surface, when an accurate knowledge of the geographical co-ordinates of important localities is necessary for cartographic and other purposes. Within this highly important and essential branch of geography are included such professional subjects of investigation as gravitation, terrestrial magnetism, geodesy, and trigonometrical survey. Indeed, so closely are the preceding sections connected and interdependent upon one another that the study of any one of them involves the study of all, and the necessity of this will become apparent when an adequate conception of the whole subject has been obtained. It is true that this department of knowledge offers many inducements for specialisation, and, where students are numerous and material abundant, there is probably an advantage in conducting investigations along special lines; but, although this method of procedure may be desirable under certain conditions, its ultimate effect must necessarily be to unduly circumscribe the field of inquiry and correspondingly narrow the mental capacity. This, I think, is undesirable in any branch of human knowledge, and especially in one so eminently calculated to broaden the intellectual power of man as that of geography.

''To the merchant and to those engaged in the pursuit of trade there is no branch of the subject of more importance than that which deals with commerce, but it has been fully recognised by all leading geographers that commercial geography cannot be satisfactorily studied without a thorough knowledge of physical geography, which underlies it and forms the basis of all earth knowledge. Thus it will be understood that no matter how interesting and important any one of the collateral sections may appear, its study can never be wholly satisfactory unless the fundamental principles of the whole subject are duly comprehended.''

We find, then, that Geography deals with the land, sea, and air of this planet that man, as we know him, inhabits, the vegetation and animal life thereon, the relation of the sun, moon, and stars to it, and their effect upon it, and upon the life expressed as form which it supports. Truly it is the most comprehensive science, the mother of all the sciences, as it were.

At an Adjourned Annual General Meeting and Conversazione of the Society, held on the 27th July, 1900—Sir Hugh Nelson, the President, in the chair, and supported by Lord Lamington, Patron of the Society—the Thomson Foundation Gold Medal Scheme was inaugurated, in accordance with the following resolution, moved by the retiring Vice-President, Mr. Alderman William Jones:—

> "That in view of the valuable services gratuitously rendered to this Society in various offices since its foundation by Mr. J. P. Thomson, this meeting requests the Council to devise and execute a scheme whereby those services can be recognised in a substantial and permanent form."

The Vice-President, Mr. Robert Fraser, seconded the motion, which was warmly supported by the Hon. Arthur Morgan, Speaker of the Legislative Assembly, and by the Hon. T. B. Cribb, Treasurer of Queensland, and carried by acclamation. (*Vide* "Queensland Geographical Journal," vol. xv., pp. 132 to 134.)

The resolution was duly considered by the Council, and it was decided to establish a "Foundation Gold Medal with which Mr. Thomson's name would always be associated as the Founder the the Society, the medal to be awarded annually to the author of such literary contributions to Geography as may be approved and deemed worthy."

The medal was struck in London by the famous medallist, Allan Wyon, F.A.S., Chief Engraver to His Majesty the King.

The first medal was awarded to Mr. Thomson for his distinguished services to Geographical Science, apart from his service to the Society, the presentation being made at the annual general meeting of the Society, August 9th, 1908. In presenting the medal the President, Sir Hugh Nelson, said: "I have now a very pleasant duty to perform. I have told you of the origin of the foundation of our Gold Medal. We designed it to be an everlasting incentive to persons, young or old, in any part of the world, but principally in Australia, to devote their talents and energies towards the Science of Georgraphy. It was agreed when first instituted that the cost of the dies and first impression of the medal should be paid for out of the funds of the Society, for the purpose, mainly, of its being presented to our worthy Honorary Secretary, to whom this Society from its inception has been very much indebted. By referring to the resolution that was passed at last Annual Meeting, you will note the high appreciation with which Mr. Thomson's services have been received by the whole Society. I can bear my testimony to his indefatigable zeal in carrying out his duties, and without flattering him to his face in any way, I can say that I hardly believed any man could devote himself to the duties of his office as Mr. Thomson has done. Under those circumstances, then, it gives me the greatest pleasure to now present him with the first impression of the Thomson Foundation Gold Medal of the Royal Geographical Society of Australasia, Queensland." (Applause.) *See* "Queensland Geographical Journal," vol. xvi., pp. 141-142.

PEEK AWARD.

In 1902 Mr. Thomson received the Peek Award of the Royal Geographical Society, London, for his great services to Geography in Queensland. The presentation was made by the President, Sir Clements R. Markham, K.C.B., F.R.S., at the Anniversary Meeting of the Society, in London, on the 26th May, 1902. In handing over the Award to Field Marshal Sir Henry Wylie Norman, formerly Governor of Queensland, for transmission to Mr. Thomson, Sir Clements Markham said:

''The Cuthbert Peek Grant has been awarded to Mr. J. P. Thomson, the founder of the Queensland branch of the Geographical Society of Australia, for the many excellent papers he has written on geography, and for his work in connection with the founding of that Society. We naturally have a very warm feeling for the colony of Queensland, for the colony of Queensland alone has subscribed to our Antarctic Expedition the sum of £1,000, while all the other Australian colonies declined to give us anything; and I believe it is due a great deal to the President of the Society and to Mr. Thomson, and to their representations, that the Government of Queensland was induced to act so generously towards us. Sir Henry Norman has kindly undertaken to receive the award for Mr. Thomson, and to decide what form it shall take, and I therefore now have great pleasure in handing to Sir Henry Norman, the former Governor of Queensland, the diploma for Mr. Thomson.''

Sir Henry Norman: ''On behalf of Mr. Thomson, and at his particular request, I return you very hearty and sincere thanks for the honour that has been conferred upon him. And from my personal knowledge he deserves this award, and I have no doubt whatever, Sir Clements, that why Queensland was the only colony that gave £1,000 was owing to the great unpaid exertions of Mr. Thomson for many years past. I think perhaps you would like to hear that your estimation, sir, of Mr. Thomson is borne out by two little extracts which I will read. Sir Hugh Nelson, the President of the Royal Geographical Society of Queensland, says: 'The welcome news was cabled to the Press here, and Mr. Thomson has requested you to receive the award on his behalf. When doing so, you will kindly express to the parent Society the extreme gratification the award has afforded to the Council, the Fellows, and Members of our branch. Such recognition by the highest authority in the world of the work of one of our members we greatly appreciate and esteem a very high honour, and I trust and believe it will be the means of stimulating all connected with our Society throughout Australia to make more strenuous exertions in furtherance of the science in which we are devoted, though humble, co-operators.' I also received a letter from the Prime Minister of Queensland in which he says: 'In connection with this matter I have the honour to add my request that you will at the same time state on the part of this Government that it is a matter of great gratification to them that a member of its State has been thought worthy to receive this honour, and to express their appreciation of the recognition therein implied of the services rendered to science by a Queensland Society.' ''—*See* ''The Geographical Journal,'' London, July, 1902, vol. xx., No. 1, p. 116.

This Peek Award, which took the form of a handsome piece of plate, specially selected by Field Marshal Sir Henry Norman, was sent out from London through the Queensland Government, and presented to Mr. Thomson by His Excellency General Sir Herbert Chermside, G.C.M.G., the State Governor, the presentation being made at a very large and representative special meeting

and conversazione of the Royal Geographical Society of Australasia, Queensland, on the 31st October, 1902. The commodious hall of the Society, at the Public Library Buildings, Brisbane, was crowded in every part. In opening the proceedings, the Right Hon. Sir Hugh M. Nelson, President of the Society, said: "We are met this evening on a very unique occasion and one unprecedented in the history of the Society—viz., to present to Mr. Thomson the Award which has been given him by the parent Society in Great Britain, the largest Society in the world connected with geographical matter. Perhaps you would like to know a little about what the Peek Award is, and what it is given for. . . . The Award is given in the first instance to practical explorers, who, in many cases, take their lives in their hands and go into new countries, partially survey them, and report what their discoveries may be; and in the second place to gentlemen who have rendered signal service to the cause of Geographical Science. And it is worthy of notice that the Award with which we are now dealing is the first instance on record where it has been made to a gentleman who was not actually engaged in the field of exploration and discovery at the time. The Award has been made to Mr. Thomson by the Society for his great services to Geographical Science in particular and Science in general, in Queensland and Australia."—*See* "Queensland Geographical Journal," vol. xviii., pp. 137-138.

The President then read a great number of communications from kindred societies and eminent public men congratulating Dr. Thomson on having received the award. These included letters of hearty congratulation from Field Marshal Sir Henry Wylie Norman, G.C.B., G.C.M.G., His Excellency the Right Hon. Lord Lamington, G.C.M.G., Governor of Bombay, and from the Federal Minister of Customs, Melbourne, with cordial felicitations and an intimation that the award would be admitted to the Commonwealth free of duty. In concluding his letters Sir Henry Norman said:—". . . . I congratulate you most heartily on receiving this distinction, which I hope will be gratifying to you and tend to encourage the cause of Geography and the success of the Society for which you have worked so well in Queensland. . . . It will be a lasting evidence that you obtained the complete approbation of the Royal Geographical Society of England in your efforts to help Geographical Science in Queensland."

And Lord Lamington concluded:—". . . I congratulate you on the receipt of the Peek Award, which is decidedly worthily bestowed in recognition of your unswerving fidelity to the advancement of Geographical knowledge, and of its progress in Queensland. . . . With renewed felicitations and best wishes for your health and prosperity."

The President (Sir Hugh M. Nelson) continuing said: "The Diploma and the piece of plate have now arrived, and I feel great gratification in now handing to Mr. Thomson the Diploma which the Society has awarded him. The Diploma bears the signatures of Sir Clements R. Markham, President; Leonard Darwin and J. F. Hughes, Hon. Secretaries; and is dated May, 1902. I have very great pleasure, Mr. Thomson, in presenting to you this Award, and to express the gratification of this Society, and I think the whole of Queensland, that it has been awarded to the right man. (Applause.) I ask your Excellency to be kind enough to present this piece of plate which accompanies the Diploma to Mr. Thomson." (Applause.)

His Excellency the Governor (Major-General Sir Herbert Chermside, G.C.M.G., C.B.): "Ladies and Gentlemen,—I am asked on your behalf and that of the President, who has deputed to me the honour of this duty, to present to our Honorary Secretary this very handsome piece of plate inscribed—

ROYAL GEOGRAPHICAL SOCIETY.

CUTHBERT PEEK GRANT FOR 1902 AWARDED TO

J. P. THOMSON,

FOR HIS GREAT SERVICE TO GEOGRAPHY IN QUEENSLAND.

I will not detain you by going over the ground that our honoured President has just traversed. I think it will suffice to remark that all here present recognise what a scientific and geographical enthusiast our Honorary Secretary is. I have had the opportunity, as doubtless you have had, of reading a record of his long labours in the cause of Science. The number of his publications alone is very high; it must be by this time nearly, if not quite, 100; for I remember I was reading one written in the early ninties, which bore a number above eighty. I need hardly enlarge before an audience like this, on the very great value to all nations, in the present age, of Science and of scientific training. The accuracy given by scientific training (and Mr. Thomson is scientific, not only as a Geographer, but he has followed Astronomy, and Surveying, and is interested in Meteorology, Geology, and kindred sciences, all of which require that accuracy of eye and recording which causes scientific societies, whenever they get reports on interesting physical matters, to at once wish to know whether they have been recorded by a trained observer), is always valuable, and is becoming daily and yearly a more indispensable part of that intellectual equipment which is necessary to success in the struggle for life and in the competition amongst nations. I am sure, therefore, that you, Mr. President, and ladies and gentlemen feel here in Queensland that we are honoured by being assembled to present to a representative Queenslander here on this occasion, this Award of that grand parent Society which is, in its interest in its own particular science, omnipresent throughout the civilised universe. Mr. J. P. Thomson, I have great pleasure in presenting you with this handsome silver plate." (Loud applause.)—*See* "Queensland Geographical Journal," vol. xviii., pp. 137-145.

On the 1st May, 1903, Dr. Thomson set out from Brisbane on an all-round-the world tour, visiting New Zealand, Samoa, Honolulu, the United States of America, Canada, the United Kingdom, and the Continent of Europe, *en route*, the results of which he published in illustrated book form, entitled "Round the World" (*vide* list of publications, No. 96). On the eve of his departure he was entertained at a Special General Meeting of the Royal Geographical Society of Australasia, Queensland, the Right Hon. Sir Hugh M. Nelson, P.C., K.C.M.G., D.C.L., President, in the chair. In addition to His Excellency the Governor (Major-General Sir Herbert Chermside, G.C.M.G., C.B.), Patron of the Society, there was present "a large and distinguished company" (*vide* report of proceedings, "Queensland Geographical Journal," vol. xviii., pp. 158-165). On this occasion the President announced, amidst hearty applause, "That in view of the distinguished services to science rendered by James Park Thomson, the Senate of Queen's University, Canada, had conferred upon him the honorary degree of Doctor of Laws." Continuing the President said:—"I think it is extremely pleasing to know and to feel that

the distinguished honours which Mr. Thomson—or, I should rather designate him, Dr. Thomson now—has received, as this follows the Peek Award given by the London Royal Geographical Society at a recent meeting, have been won by him without any outside patronage or influence whatever, and by sheer force of merit. (Applause.) He has devoted himself, and devoted those very distinguished qualifications which he possesses all of a very high order, voluntarily to the cause of Science, and it is very gratifying to me, and I think it must be so to the whole of the members of this Society, to know that these merits have been appreciated, not only by ourselves, but also by others, who perhaps are more qualified to judge of the merits of Dr. Thomson than even we are. The very high honour paid to him reflects itself upon this society, of which Dr. Thomson has been the distinguished Honorary Secretary from its very foundation; in fact, he is the Founder of this Society; and doubtless without the immense exertions that he has put into it the Society would never have flourished in the way it has. I have the greatest pleasure, Dr. Thomson, in congratulating you on the distinguished honour which has now been conferred upon you.'' (Applause.)

In 1906 Dr. Thomson was invited by the New South Wales Government to assist in the inquiry respecting the proposed Burrinjuck Reservoir and Northern Murrumbidgee Irrigation Scheme. And about the middle of that year he inspected and examined the site of the projected reservoir and dam, reported and gave evidence in regard to the geographical conditions of the Murrumbidgee basin and as to the value or otherwise of the scheme generally for irrigation purposes, his reports on the same being most exhaustive and comprehensive. This great scheme, it may be stated, involves an expenditure of £1,574,008.

That the late Right Honourable Sir Wm. MacGregor, former Governor of Queensland, entertained a very high opinion of Dr. Thomson's scientific work is well known to the members of the society, especially to those present at the twenty-fifth anniversary celebration, on the 27th August, 1910. On that occasion His Excellency the Governor said:—''I have been asked to represent, on this important occasion, certain learned bodies in the United Kingdom. First of all, I was invited by Sir Donald Macalister, the principal of the University of Glasgow, to represent that institution. Then I was asked by Sir William Turner, principal of the Edinburgh University, and also by the President and Secretary of the Royal Geographical Society of England, to represent those institutions at this gathering. Now, I do not understand that I was asked to represent those three great learned bodies simply to congratulate this society on having attained its twenty-fifth anniversary, but rather to compliment it on its splendid achievements. I take it that my mission, if I may venture to so describe it, is very much more to express appreciation of the work of the society, than to congratulate it on its age. I myself have been connected with the society in a measure for over a score of years, so that I am able to form a fairly good opinion as to what has been accomplished. In conversations I have had with the former President of the parent society (Sir Clements Markham), and with the secretary (Dr. Scott Keltie) they both have expressed very high appreciations of the work done by the Queensland society, the principal credit for which they certainly were inclined to ascribe to the indefatigable Secretary, Dr. Thomson, who not only had originated the society, but had lent the motive power to it ever since.—''Queensland Geographical Journal,'' vol. xxv., p. 142.

And in a letter written during the Great War (11th January, 1916) Sir William MacGregor further expressed himself as follows:—"My Dear Dr. Thomson,—May I offer you my congratulations on your wonderful success in not only keeping the Royal Geographical Society going, but in actually infusing into it greater vitality than ever at a time when one might have expected it to die of inanition. You have certainly achieved a very meritorious record, in having created and nursed into years of discretion and honour a society that is necessary to complete the education of a well-instructed community. I know that your work is appreciated by the Royal Geographical Society here. It is very gratifying that you are able to have His Excellency the Governor as President. You were also fortunate in Sir Arthur Morgan as a President."

Since Dr. Thomson received the Hon. Degree of Doctor of Laws, he has not rested on the honours won but has worked harder, if possible, to broaden and extend a knowledge of Geography in its widest signification than before, and as a result of the work which he has accomplished he is now honoured by His Majesty with the title of Commander of the British Empire. I know that you will agree with me that the honour is well merited, and more than well merited, and I hope that we may all live to see the day when our learned and much distinguished friend, and co-worker, and leader in this great science of Geography, will receive a still further honour at the hands of His Majesty the King which will entitle us to address him as Sir James Park Thomson.

In concluding, the Chairman read a large number of communications, congratulating Dr. Thomson, from which the following brief extracts are taken:—

"Most heartily do I congratulate you upon the well-deserved honour which you have just received. I know how untiring your efforts have been, and I am truly glad that they have been appreciated.

"LAURA ALLAN."
(Brisbane.)

"My dear Thomson,—A thousand congratulations on your C.B.E. Although somewhat belated they are not the less sincere. I am really tremendously pleased, because you have done much heroic spade-work which has not always been appreciated in the past, but now you have received an acknowledgment of your services from His Majesty. Well, good luck go with you, and may you long be spared to enjoy this new and special honour which has been approved by the Sovereign himself.

"Our renewed congratulations,
"(Sgd.) W. L. ALLARDYCE."
(His Excellency Sir Wm. Allardyce, K.C.M.G., Governor of Tasmania.)

"May I offer Dr. Thomson my sincere congratulations.

"PEARSON W. CAMERON."
(Ipswich.)

"It was both a pleasure and a duty to congratulate you on your new honour—one that you have done so much to win. The Geographical Society owes you a very real debt, and I think the members generally realise it.

"A. H. CHISHOLM."

(Royal Australasian Ornithologists' Union, Brisbane.)

"I am very sorry indeed that it is impossible for me to come and offer my most hearty congratulations to your most distinguished general secretary Dr. J. P. Thomson.

"DR. J. V. DANES."

(Consul-General of the Czechoslovak Republic, Sydney.)

"Accept my heartiest congratulation on your receiving such a distinguished Order from His Majesty the King. This kind of thing tends to show that men doing good work even on the confines of our universal Empire are not overlooked. I trust you will be spared for many years to adorn the position you have so ably and honourably held in the past.

"You may, no doubt, remember on one occasion you told me that everything possible was known about the moon; I ventured to say there was another side to that matter. There is, however, no other side in this matter but that a clever, painstaking, scientific man has been acknowledged and rewarded from high places.

"JAMES DE CONLAY."

(Warwick.)

"It was with the keenest delight that I heard from our mutual friend and Vice-President of the Royal Geographical Society, Hon. Dr. Taylor, that His Majesty the King had been pleased to confer on you the Order of Commander of the British Empire. I regard this act of His Majesty not only as a tribute to your personal worth and great scholarship, but also as a recognition of the Royal Geographical Society in Queensland, to which you have rendered such distinguished service.

"I join most heartily with the members of your family and with your wide circle of friends in rejoicing over the well-deserved honour you have received.

"JAMES DUHIG,

"Archbishop of Brisbane."

"Let me take this opportunity to offer my congratulations on this your latest distinction.

"E. E. EDWARDS."

(Brisbane.)

"I have great pleasure in congratulating you on having received from His Majesty the King the Order of Commander of the British Empire.

"W. EFFEY."

(Brisbane.)

"Permit me, if you please, to heartily congratulate you upon the much-deserved honour bestowed upon you by His Majesty the King.

"GEO. FISH."

(Redcliffe.)

"I wish to extend to you, on behalf of myself and the Greek community, my hearty congratulations, and I trust you will live many years to enjoy the privilege.

"As a member of the Royal Geographical Society, I am proud that we have so distinguished a person and so ardent a scientist in our midst.

"C. FREELEAGUS,

"Consul for Greece."

"Kindly accept my congratulations on being honoured by the King. It is an honour to the Society which I am sure the members fully realise.

"ALICE J. ALISON GREENE."

(Moreton Bay High School, Wynnum.)

[*Telegram.*]

"Hearty congratulations upon Commandership British Empire Order.

"HAY."

(Clifford H. Hay, M.V.O., Secy., Premier's Dept., Sydney.)

"I specially write to offer you my sincere congratulations. I trust you may be long spared in good health to enjoy the honour conferred upon you, and to continue the good work which you are doing for the community.

"ABRAHAM HERTZBERG."

(Messrs. A. M. Hertzberg and Co., Brisbane.)

"Please allow me to heartily congratulate you on the honour which has been conferred on you of C.B.E., and I am glad the work you have done for the R.G.S. of Queensland has been recognised.

"D. LE SOUEF,

"Director, The Royal Zoological and Acclimatisation Society of Victoria."

"I beg to very heartily congratulate you on the honour conferred upon you, and to say you richly deserve the appreciation of His Majesty and the tribute of your fellow citizens.

"Wishing you much prosperity.

"THOS. J. McMAHON."

(Sydney.)

"Please accept my heartiest congratulations.

"H. W. MOBSBY."
(Brisbane.)

"I take this opportunity of congratulating you upon the well-earned recognition of your devoted services to the Society and other scientific interests of the community.

"E. N. MERRINGTON."
(St. Andrew's Church, Creek street, Brisbane.)

" I am very pleased to learn that the invaluable services you have given to the Royal Geographical Society of Australasia, Queensland, for more than thirty-five years have received such well-merited recognition from His Majesty the King, in conferring upon you, as Founder and Honorary Secretary, the distinguished Order of Commander of the British Empire.

"I would ask you to accept my most hearty congratulations on the honour conferred, which I am sure will be highly appreciated by the Council and members of the Society.

"GEO. PHILLIPS."
(Alderley.)

"May I offer my sincere congratulations on having conferred on you by our King the Order of Commander of the Brisish Empire (C.B.E.)?

"That you may be spared many years to carry on the good work of the Society is the wish of yours faithfully,

"JAMES H. PHIPPS."
(East Brisbane.)

"Both Mrs. Thompson and I were looking forward with pleasure to last night as being privileged to personally congratulate you on the honour bestowed on you by His Majesty the King, and then at the last minute we were detained. Being unable to shake you by the hand, please accept our none the less hearty congratulations, and our hopes that you may have long life and good health in the future.

"DR. ROBERT THOMPSON."
"Hoylake," Norman Park, Brisbane.

"I could not do otherwise than express to you my gratification at your having been selected for Royal recognition for promoting the advancement of science, since your efforts in this direction, pursued for a quarter of a century (and longer), constituted a matter within both my knowledge and experience, and it was pleasing to find that—once in a way—honour was bestowed where merit specially dwelt.

"HENRY TRYON."
(Department of Agriculture and Stock, Brisbane.)

"I take this opportunity to convey my warmest congratulations to you in the honour that His Majesty the King has conferred on you. You have been a public spirited citizen, and all honour is due to you for the excellent work

you have done in the interests of the Royal Geographical Society in this distant portion of the Empire.

"Trusting you will be favoured with good health for many years to come,

"A. D. WALSH."

(Dalgety and Co. Brisbane.)

"Accept my personal congratulations on the well-merited distinction which has been bestowed upon you.

"G. W. WHATMORE."

(Queensland Motors Limited.)

"First of all, let me congratulate you most heartily on the great honour conferred upon you by His Majesty the King. I must say, knowing you as I do, that you deserved it in every way, and I am glad that your loyal services to the Society and the public at large have been so fittingly rewarded.

"DOROTHY M. WOOD."

(Brisbane.)

Mr. JNO. P. WILSON (Vice-President) moved: "The members of the Royal Geographical Society of Australasia, Queensland, at this special meeting on 29th Nov., 1920, desire to thank His Majesty the King for the honour conferred upon the Society by creating Dr. J. P. Thomson, the Founder of the Society, and its Hon. Secretary, a Commander of the Order of the British Empire." He said this decoration would not have been bestowed by the King unless by the recommendation of some person. He understood that the nomination had been put in by His Excellency the Governor-General of Australia, Sir Ronald Munro-Ferguson. His Majesty the King often had no personal knowledge of the person on whom the decoration was bestowed. But the person who made the nomination had every knowledge of the person, and Sir Ronald Munro-Ferguson would not have taken this step unless he had had a high opinion of Dr. Thomson's work and geographical knowledge. He understood H.R.H. The Prince of Wales was the Grand Master of this Order. After Dr. Taylor's exhaustive paper very little was left for him to say. From his first introduction to the Society he had always thought of it in connection with Dr. Thomson. He could never think of the Society without thinking of Dr. Thomson, for he had been the Founder and the Father and the motive power of the Society. (Applause.) They—as old folks—sat on the Council, but Dr. Thomson was the one who thought of all the things to be done, and kept in touch with the scientific men of Australia and got them to come and give lectures in the rooms. (Applause.) Dr. Thomson was a Scotsman, and that was why he stuck so well to his work. That was why he was so assiduous. That was why he kept keeping on. He had a persuasive way with him, and often made them do a thing when no one else could have succeeded in getting them to do it. He had also always been very courteous and had made himself liked by the members of the Council. He hoped Dr. Thomson would be long spared as the engine that worked the Society and kept it alive. (Applause.) He hoped he would live very long to enjoy the honours conferred upon him, and to keep alive the interest in the Society.

His Grace ARCHBISHOP DUHIG said he had been requested to second the resolution that had been so ably proposed by Mr. Wilson, the Vice-President of the Society, and he did so with very great pleasure. There were two gentlemen named Thomson whose friendship he valued highly. The one was the grand old mariner and explorer Captain Thomson, with whom he made many pleasant voyages when he was at Rockhampton—(applause)—and the other was Dr. Thomson, whom they had gathered together to pay a tribute to that evening. There was no piece of news received by him for a long time that gave him greater pleasure than the news of Dr. Thomson having been created a Commander of the Order of the British Empire. (Applause.) This Order was appropriate for men like him, because Dr. Thomson belonged not to Queensland, but to the British Empire. (Applause.) He would have liked to see Dr. Thomson made a Knight at once, so that he might have been Sir James. (Applause.) But that was a pleasure in store for him and them, and they were delighted that this present distinction had been conferred upon him. He did not think anyone deserved it more than he did in Australia. (Loud applause.) They all owed a debt of gratitude to those engaged in the work of scientific research here in Australia. No other part offered a wider field than the Pacific Islands and Australia for scientific research, and no man was better qualified to speak on the geographical features of the Islands and Australia than Dr. Thomson. (Applause.) It was very much to be regretted that a man of his high attainments should be merely a Government officer of the State instead of being in the service of the Commonwealth Government. He hoped the day was coming when Governments and Municipal Councils would make more use of scientific men. They were in a very young country, having very great resources, and the greatness of their future no one could sum up. It was necessary they should employ every resource at their command. Science must come largely into the development of Australia. He went about the country and saw many things which he regretted. He saw that there was almost a total absence of irrigation. They had periods of drought which they regretted and wept over at the time, but they did nothing to remedy the matter, and when the bountiful season came again they forgot all about the drought. He had seen the most wanton destruction of the finest timbers here to be found in any part of the world. Only the other night they held a meeting at the School of Arts to take steps towards the preservation of National Park, but the destruction of the fauna and flora still went on, and unless they brought people to a rude awakening there would be but little left for those who came after them. He was delighted at His Majesty the King honouring a man of the attainments of Dr. Thomson, and that His Majesty had recognised the services of such a man to Empire and to Queensland. (Applause.) If he (his Grace) was going to travel through Europe directly there was no man whom he would prefer to have a letter from than Dr. Thomson, as he was known to all the learned societies. Dr. Thomson had brought into the Society some very distinguished men, and the latest he had made an Hon. Member was H.R.H. the Prince of Wales himself. (Applause.) Dr. Thomson had prepared all the Addresses to Governors and others on their coming and their going away, and every address had been a gem. So they would see that Dr. Thomson was distinguished in literature as well as other things. (Applause.) Finally he was a Scotsman, and it was appropriate that they should be honouring him on the eve of the Feast of St. Andrew.

(Applause.) He congratulated him, and joined with them all in expressing the hope that he would be long spared to enjoy the honour conferred upon him and his work. (Loud applause.)

Mr. Henry Tryon (Government Entomologist and Vegetable Pathologist) said he had been very long associated with Dr. Thomson, and he felt it was due to him to say something in connection with the business of the gathering that night. He remembered when Dr. Thomson came to Queensland first. He came then with good reputation, having been in Fiji, where he had been associated with some astronomical work. Soon after his arrival Dr. Thomson gave them a most interesting description of Fiji itself. He met him, too, when he was in Sydney—representing Queensland, and for the purpose ot assisting in founding an Australasian Association for the Advancement of Science. Ever since then, the ideas as of a scientific man he had set before them had been maintained in the Geographical Society, to which he had devoted the greater part of his life.

He was reminded of a statement made by Sir Edward Grey some years ago. He was addressing a meeting in 1913 in England, and was extolling the importance of geographical science. Sir Edward Grey then said: "I am convinced that the study of Geography is absolutely essential for the maintenance of an empire, and especially our Empire." This showed the importance attaching to a society like this, that stood for the advancement of Geographical science. They had heard from Dr. Taylor, Dr. Thomson's idea of what should be the scope of Geography. When he came here first, he stated, in the text of our Constitution, what Geography connoted—in its scientific, commercial, educational, and historical aspect. The Geographical Society, in the conduct of its business, had most actively followed and lived up to his ideal of what geographical science should be. If they looked at its record, contained in some thirty-five volumes of its Transactions, they would get some notion of the Society's accomplishment under the leadership of his distinguished friend. Those volumes embodied work on every subject within the vast scope implied by geographical science. His Grace the Archbishop had referred to Dr. Thomson's literary ability. He (Mr. Tryon) was somewhat critical, and could say that if they looked through those thirty-five volumes they would hardly see a literary error—a fact which redounded very greatly to Dr. Thomson's literary capacity. It was an epitome of recent research in geographical science itself, and, as Dr. Taylor had said, Dr. Thomson had been one of the largest contributors to these records thereof. (Applause.) He did propose dwelling upon the essential features of his work, but Dr. Taylor had already done this. There was no conquest of geographical science that he had not enlightened them on. He was interested again in what he said of the value of science to Australia, and Queensland especially. Dr. Thomson stood for the advancement of science; and he was sure, if other people and societies had tried to emulate his example, science would have advanced to a greater degree in Queensland than it had done. From his (the speaker's) point of view, Queensland, apart from its contributions to geographical science, was one of the most backward countries in the world in its cultivation of science. He regretted that science found very little expression in the education of their youth. If they looked at the record of the University they would see how very little attention was bestowed on science—especially biological science and geographical science. It was to the great credit of the University of Sydney that it had founded a chair of

geography, which would make for the advancement of that science in years to come. This realisation of this ideal of what constituted geography. It was interesting to recall that so distinguished a geographer as the late Sir William MacGregor—a great explorer and eminent literateur—had stated that ''the work of the Royal Geographical Society was well known and much appreciated,'' and that he added, ''It is recognised that your Society has had no small share in giving to geography that wide scope which has made it one of the most comprehensive branches of human knowledge.'' (Applause.) That was the greatest testimony that could be given to the Society—and Dr. Thomson; for they could not talk of the Society without Dr. Thomson, too:—They called him, in fact, ''Geographical Thomson.'' (Loud applause.) When he was in Paris he was very much interested to find that Dr. Thomson was spoken of there; and, that there was work contributed by him to the French Geographical Society's organ. When he got to London, he heard that one of the most valuable contributions—contributed in 1902—was a paper by Dr. Thomson on ''The Physical Structure of Australia''; and in Washington he had the pleasure of meeting the secretary of a kindred society which included 74,000 members, and that secretary specially commended the work of this Society and Dr. Thomson. (Loud applause.) Therefore, it was very fitting indeed that His Majesty should have thought good to honour the Society through Dr. Thomson, with this distinguished order now conferred upon him, and he only hoped he would live to reap higher honours. (Loud applause.) If Dr. Thomson had his due he would be one of the professors of the University. (Applause.) To conclude:—Dr. Thomson had spent years in compiling a work on Australia, and why hadn't it appeared? He (the speaker) knew the reason why, and so he hoped they would not now allow their gratitude now expressed to evaporate, but give effect to this great project on which his friend had been engaged; bringing out, in effect, in consolidated form, the hundred and one papers Dr. Thomson had contributed to the Society. (Loud applause.)

Mr. A. Jones, of Rockhampton, said as a representative of Central Queensland he wished to add his appreciation of the work done by Dr. Thomson. They needed observers and thinkers, and Dr. Thomson was one of those. He had, therefore, much pleasure in supporting the motion. (Applause.)

Madam Struver Le Guerin also offered her congratulations to Dr. Thomson on the distinguished honour conferred, and expressed the hope that he would live long to enjoy all his honours.

The motion was carried with great enthusiasm, and followed by three hearty cheers for Dr. Thomson.

Dr. Thomson, in replying, said he did not feel equal to the occasion at all. But there was one thing he could not allow to pass, which was given in the remarks of his Grace the Archbishop and Mr. Wilson, and that was as to the inactivity of members of his Council and the officers of the Society. He felt proud, and to the last day of his life would continue to feel proud, of having for so long been associated with the body of men conducting the affairs of this Society in the form of a Council and officers. It had been going a long way back and there had never been any one connected with the Council or any office of the Society for whom he had not really formed a very deep affection indeed. (Applause.) He had received the greatest possible support and strength from their hearty and loyal co-operation, and he considered it as the first duty

devolving upon him, in receiving this honour from His Majesty the King, to recognise the great compliment they had paid him by their presence there that night. It would be unworthy of him if he did not acknowledge at once the services rendered to the Society by the present and past Councils towards making it what it was to-day. It was really due to them and not to himself as a single individual at all—this honour; and to the Vice-Presidents, and his Grace the Archbishop, he tendered his heartiest thanks for their loyal support. (Applause.) One of the features of the evening's proceedings that had touched him more than anything else had been the allusion made by Mr. Tryon to the work of the Society, and his (Dr. Thomson's) own work. He valued Mr. Tryon's opinion very greatly, having been long associated with him. There were few men in this community or the Australian Commonwealth whose opinion he valued more in the matter of science than his. Mr. Tryon was the greatest enthusiast they had. He had laboured like himself very hard in the interests of science, because he loved science for its own sake and not for any consideration he was likely to get for it. He should feel grateful to him as long as he lived. They had been given the true history of the Society by Dr. Taylor, and there was nothing left for him to add, but merely to give expression to his gratitude for this exhibition of their kindness, and to thank them on his own behalf and on behalf of his family. (Loud applause.)

APPENDIX II.

CONSTITUTION AND RULES

OF THE

Royal Geographical Society of Australasia,

QUEENSLAND.

FOUNDED 1885.

Amended at a Special General Meeting, 21st March, 1900.

The Royal Geographical Society of Australasia, Queensland, was formed at a meeting held at the Town Hall, Brisbane, on the 10th July, 1885.

Title.

1. "The Royal Geographical Society of Australasia, Queensland."

INTERPRETATION—SOCIETY.

Whenever the word "Society" is used in the following Rules and By-laws, the same shall be read and construed to mean the Royal Geographical Society of Australasia, Queensland.

Objects.

2. The objects of the Society are:—

A—GENERAL.

I. Scientific—The advancement of geographical science in its widest sense; the study of physical geography, and the exploration of Australasia, with the islands and seas adjacent thereto, and to obtain information upon their physical features, fauna, flora, geological formations, &c.

II. Commercial—The study of commercial geography, natural and artificial products, and the manufactures of various countries.

III. Educational—The dissemination of knowledge of physical, commercial, and political geography amongst all classes, by means of public lectures and publications.

IV. Historical—The collection and publication of historical records of geographical interest, and of memoirs of men distinguished by the advancement of geographical science in Australasia.

B—SPECIAL.

I. The collection of material for the compilation of a reliable Geography of Australasia.

Constitution.

3. The Society shall consist of Ordinary, Corresponding, and Honorary Members and Fellows.

I. Any lady or gentleman may become an Ordinary Member, subject to election.

II. Persons of distinguished scientific attainments, who have promoted the objects of the Society, may be elected Corresponding Members.

III. Honorary Members shall be elected from among such eminent persons as have rendered valuable service in the cause of geographical science.

IV. Fellows—The Council may confer the Diploma of Fellowship upon such eminent persons as have rendered valuable services to geographical science; on persons of distinguished scientific attainments; on those who have promoted the objects of the Society; and on Honorary and Honorary Corresponding Members of the Society, without the payment of diploma fees. On Ordinary Members, on payment of a nominal diploma fee, subject to the following conditions, namely:—(*a*) Upon written application: Those who have compounded for life membership and are deemed worthy of the distinction by the Council; (*b*) Upon written application: Those who are not in arrears with their annual subscriptions, and are, upon the recommendation of the Council, approved by the Society at an ordinary monthly meeting. Of the honorary class the number of Fellows shall not exceed ten. Each Diploma, after being approved by the Council, shall be signed by the President, and by the Hon. Secretary of the Society. Members who receive the diplomas shall have the privilege of designating themselves "Fellows" of the Society, and may use the initials F.R.G.S.A.Q. after their names as long as they continue to be members of the Society.

Election and Privileges of Ordinary Members.

4. Every person desirous of admission as a member of this Society shall be nominated by two Ordinary Members; the nomination (to be in Form I. of the Appendix) to be delivered to the Secretary in writing, and submitted to the Council at its next meeting, and at the next ordinary monthly meeting thereafter the name of such person shall be put up for election.

5. Every person so elected shall, upon payment of his entrance fee and subscription, become a member of this Society; and shall be presented by the Secretary with a copy of the rules, and a Diploma of Membership.

6. The Ordinary Members of the Society have the right to be present and vote at all meetings of the Society; to introduce two visitors at the general or ordinary meetings upon entering their names in the visitors' book; but no visitor shall take part in a discussion unless specially invited to do so by the Chairman. Each member to be entitled to receive a copy of the Society's official publications, and to have access to the library and other public rooms of the Society.

7. Any Ordinary Member is eligible to be an officer or member of the Council of this Society.

Election of Corresponding and Honorary Members.

8. The Corresponding and Honorary Members shall be elected under the same conditions as laid down in Rule 4 for Ordinary Members. They shall be exempted from the payment of fees, and may exercise the privileges of Ordinary Members, except that they shall not vote or hold office or seat on the Council.

Government by Council.

9. The government of the Society shall be vested in a Council consisting of twelve (12) members including the officers, all of whom shall be elected annually by the Society as hereinafter directed.

Officers.

10. The officers of the Society shall consist of a President, one or more Vice-Presidents, an Honorary Secretary, and an Honorary Treasurer.

Property.

11. The Council shall have the management of the affairs and property of the Society, and the disbursement of the funds.

12. The whole of the property and effects of the Society of what kind soever shall be vested in the President, the Vice-President, the Honorary Secretary, and the Honorary Treasurer for the time being, in trust for the use of the Society.

Election of President and Vice-President.

13. The President and Vice-President shall be elected by ballot, at an Annual General Meeting of the Society, and shall be eligible for re-election, provided that they shall not hold office for more than two (2) years successively. The President, or in his absence the Vice-President, shall preside at all meetings of the Society and of the Council, at which he may be present.

Election of Honorary Secretary and Honorary Treasurer.

14. The Honorary Secretary and the Honorary Treasurer shall be elected by ballot at an Annual General Meeting of the Society, and shall be eligible for re-election.

Election of Ordinary Members to the Council.

15. The election of Ordinary Members to the Council shall be by ballot at an Annual General Meeting of the Society.

Duties of the Council.

16. The Council shall meet once in every month for the transaction of business, at such time and place as may be appointed. Special meetings of the Council may be convened at any other time on the authority of the President, the Vice-President, or of three members of the Council. Due notice of all Council meetings to be sent to each member.

17. The Council shall prepare an annual balance-sheet, and a report on the operations of the Society for the preceding year, for presentation at the Annual General Meeting.

18. No business shall be transacted at any meeting of the Council unless three members of the Council are present; in case of equality of votes, the Chairman shall have an additional or casting vote.

19. It shall be the duty of the Council to decide on the papers to be read at the monthly meetings, and to determine as to their publication, in whole, or in part.

20. Any member of Council personally interested in a question before the Council, shall, if requested to do so by the Chairman, withdraw during its consideration.

21. If, in the interval between two annual meetings, any vacancy in the Council occurs, the Council may appoint some member of the Society to temporarily fill such vacancy until it is filled by election at the Annual General Meeting.

Duties of the Honorary Treasurer.

22. The Honorary Treasurer shall have special charge of all moneys and accounts, and shall see to the collecting of all moneys due to the Society, and shall submit quarterly to the Council a list of the names of such members as may be in arrears with their subscriptions. He shall pay all moneys received into a bank account, to the credit of "The Royal Geographical Society of Australasia, Queensland."

23. All accounts due by the Society shall be approved by the Council before being paid, and all payments shall be by cheque, signed by the Honorary Treasurer, and countersigned by one of the Council members.

24. The Honorary Treasurer shall prepare an annual statement of receipts and disbursements, to be audited by Auditors appointed at the preceding annual general meeting. Any vacancy occurring in such appointment to be filled by the Council.

25. This statement shall be submitted, audited, to the Council at its meeting prior to the annual general meeting.

Duties of the Honorary Secretary.

26. The Honorary Secretary shall attend and take minutes of the proceedings of the Society and of the Council respectively, and see that all such minutes are entered in the several minute books, and shall keep a complete list of the members of the Society, with the name and address of each accurately set forth; he shall conduct all correspondence, and transact all the routine business; and shall have charge of all property, books, maps, papers, &c., and shall see that the same are properly recorded and catalogued.

Fees.

27. Ordinary Members shall pay £1 1s. entrance fee, and subscribe £1 1s. per annum, payable in advance, to the Honorary Treasurer on or before the first day of the session.

28. A member may at any time compound for future annual contributions by the payment of the sum of £10 10s.

29. Members elected during the second half of the session shall pay half the usual fee for that year. No member shall be responsible for any expenditure beyond his annual subscription.

30. Any Ordinary Member who has not paid the year's contribution during the currency of the year shall be liable to have his name removed by the Council from the list of members of the Society: Provided always that written application for the same shall first have been made by or on behalf of the Treasurer:

And provided, also, that the Council shall have power to restore the defaulter's name at his request, and after payment of arrears. No member shall be entitled to vote or hold office while his subscription for the previous year remains unpaid.

Session.

31. Session shall commence in the month of July, and last eight calendar months.

Meetings.

32. The meetings of the Society shall be—

I. Annual general meeting.

II. Ordinary monthly meeting.

III. Special general meeting.

33. The annual general meeting shall be held at the commencement of every annual session in the month of July, on a day to be fixed by the Council, to receive the President's address and the report of the Council on the state of the Society, and to discuss such subjects as may be brought forward relative to the affairs of the Society, and to make the elections for the ensuing year. If, after the lapse of fifteen minutes, less than ten members are present, it shall not be lawful for the meeting to proceed to business, except for the purpose of adjournment, and the meeting shall stand adjourned until a day and time then resolved upon.

34. The ordinary monthly meetings of the Society shall be held in each month of the session, on such days and at such place as the Council may appoint. The business shall be conducted in the following order, unless otherwise decided:—

I. The reading and confirming the minutes of last meeting.

II. Election of new members.

III. The Secretary shall announce any donations made to the Society since its last meeting, and read any special communications.

IV. Motions, of which notice has been given, to be considered, and notices of motion for the next meeting to be read.

V. The consideration of any special subject which members may desire to bring forward, provided it be approved by the Chairman.

VI. Any paper or subject notified in the circular shall then be read.

VII. The Chairman to invite discussion.

VIII. Notice of papers for next meeting.

35. No motions relating to the government of the Society, its Rules or By-laws, the management of its concerns, or the election, appointment, or removal of its officers, shall be made at any ordinary monthly meeting.

36. Except as above provided, no paper shall be read at any meeting which has not been notified to and approved by the Council; and every paper read before the Society shall be the property thereof, and immediately after it has been read shall be delivered to the Secretary.

37. A special general meeting shall be called by the Council when considered necessary, or when required by the requisition in writing of any ten members to do so, the requisition to specify (in the form of a resolution) the purpose for which the meeting is required to be called; and at the meeting the discussion

shall be confined to the subjects mentioned in the notice convening such meeting. Ten members shall form a quorum.

38. All meetings of the Society shall be convened by notice written or printed, sent by the Secretary to every member resident in the colony, at least seven days before the date fixed for meeting. The circular shall state as far as convenient the subjects to be brought before the meeting.

39. The President shall take the chair at all meetings of the Society; or, in the event of his absence, the Vice-President; or, in the event of his absence, members present shall elect a Chairman, being a member of Council, if such be present.

40. No person shall at any meeting, unless with the express permission of the Chairman, address the meeting otherwise than in a standing position.

Retirement of Members.

41. Any member may, on payment of all arrears of his annual contributions, withdraw from the Society by signifying his wish to do so by letter under the member's own hand, addressed to the Secretary. Such member shall, however, be liable for the contribution of the year in which the wish to withdraw has been signified, and shall also continue liable for the annual contribution until all books or other property borrowed shall have been returned to the Society, or full compensation for the same, if lost or not forthcoming, shall have been made. Should there appear cause in the opinion of the Council to require the retirement from the Society of any member (otherwise than as provided by Clause 30), a special general meeting shall be called by the Council for that purpose; and if three-fourths of those voting agree by ballot that such member shall retire, the Chairman shall declare the same accordingly, whereupon the name of such person shall be erased from the list of members.

Archives.

42. The archives of this Society shall be kept in Brisbane.

Publications.

34. A journal of the Proceedings and Transactions of this Society shall be published from time to time under the authority of the Council.

Alteration of Rules.

44. Any repeal or alterations of the Rules, or additions thereto, of the Society shall not be considered unless a written notice of motion, signed by not less than five members, shall have been given to the Council and read at three ordinary monthly meetings of the Society, and thereupon such motion may be brought forward at the next annual general meeting; or, if thought desirable, a special meeting may be convened before such annual general meeting to consider the resolution; and any resolution passed at such special meeting, altering or repealing the rules, shall be in force until the annual general meeting next following, and, if not then confirmed, shall thereafter be held void and of no effect:

Provided that any of the Rules may be suspended from time to time, but a motion shall not be put to suspend any Rule or Rules except by leave, which leave shall not be granted if six members dissent therefrom.

By-Laws.

45. The Council shall have power to make By-laws for the conduct of its business and the business of the Society generally: Provided no such By-laws shall be repugnant to the objects of the Society or to any Rules or By-laws made by the Society at any of its general meetings.

BY-LAWS RELATING TO COMMUNICATIONS TO THE SOCIETY.

1. Every paper which it is proposed to communicate to the Society shall be forwarded to the Honorary Secretary for the approval of the Council.

2. The Council may permit a paper written by a non-member to be read, if communicated through a member.

3. In the absence of the authors, papers may be read by any member of the Society appointed by the Chairman or nominated by the author.

4. No paper or communication read before the Society shall be published without the consent of the Council.

5. The Council shall decide, not later than at its meeting next following the reading of a paper, whether or not it shall be printed in the proceedings; and if not, such paper shall be returned, if desired, to the author.

6. All communications intended for publication by the Society shall be clearly and legibly written on one side of the paper only, with proper references and in all respects in fit condition for being at once placed in the printer's hands.

7. In order to assure a correct report, the Council requests that the paper shall be accompanied by a short abstract for newspaper publication.

8. The author of any paper which the Council has decided to publish will be presented with twenty copies; and he shall be permitted to have extra copies printed, on making application to the Honorary Secretary and on paying the cost of such copies.

9. A proof corrected by the MS. shall be submitted to the author for revision.

ANTHONY JAMES CUMMING, GOVERNMENT PRINTER, BRISBANE.